Part 1 General

1.1 ACCESS AND EGRESS

.1 Design, construct and maintain temporary "access to" and "egress from" work areas, 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 the Contract Administrator 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 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

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

.6 Gateway Construction and Engineering Ltd. maintains control and security for the site and facility.

.1 Co-ordinate with Gateway Construction and Engineering Ltd. for access into Work areas shown on Drawings.

1.3 WORKING HOURS

.1 The Contractor will be restricted to the working hours of gateway Construction and Engineering Ltd. as follows:

.1 Normal working hours:

.1 Monday through Friday 7:00 a.m. to 4:30 p.m.

.2 Co-ordinate with Gateway Construction and Engineering Ltd for Work outside of the above noted times.

.3 Pay costs for Gateway Construction and Engineering Ltd. to provide access outside of normal work hours at no additional cost to the City.

.2 Notwithstanding the above, all Work shall be completed in conformance with City of Winnipeg Neighbourhood Liveability By-Law No. 1/2008.

1.4 SPECIAL REQUIREMENTS

.1 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.2 Gateway Construction and Engineering Ltd. maintains control and security for the site and facility.

.1 Keep within limits of work and avenues of ingress and egress established on Drawings.

.2 Maintain site and security of building as shown on Drawings.

1.5 BUILDING SMOKING ENVIRONMENT

.1 Smoking is not allowed.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

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

.4 Notify the Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.5 Verify field measurements and affected adjacent Work are co-ordinated.

.6 Contractor's responsibility for errors and omissions in submission is not relieved by the Contract Administrator 's review of submittals.

.7 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by the Contract Administrator review.

.8 Keep one 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 shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Manitoba, 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 co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow 5 working days for the Contract Administrator 's review of each submission.

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

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

.7 After the Contract Administrator 's review, distribute copies.

.8 Submit shop drawings electronic copy in PDF format for each requirement requested in specification Sections and as the Contract Administrator may reasonably request.

.9 Submit product data sheets and brochures electronic copy in PDF format for requirements requested in specification Sections and as requested by the Contract Administrator where shop drawings will not be prepared due to standardized manufacture of product.

.10 Delete information not applicable to project.

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

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

1.3 SAMPLES

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

.2 Deliver samples prepaid to the Contract Administrator 's business address.

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

.6 Make changes in samples which the Contract Administrator 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 CERTIFICATES AND TRANSCRIPTS

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

.2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSPECTION

.1 Allow the Contract Administrator access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by the Contract Administrator instructions, or law of Place of Work.

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

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

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged for purpose of inspecting and/or testing portions of Work.

.1 Cost of such services will be paid by the Contractor as a Unit Price component in accordance with Bidding Procedures Clause B10 – Prices.

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

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

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by the Contract Administrator at no cost to The City. Pay costs for retesting and reinspection.

1.3 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work.

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

1.4 PROCEDURES

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

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

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

1.5 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by the Contract Administrator as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of the Contract Administrator it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, The City will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by the Contract Administrator.

1.6 REPORTS

.1 Submit copies of inspection and test reports to The City and the Contract Administrator.

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

.3 Provide copies of concrete test results to Concrete Supplier.

1.7 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

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

1.8 MOCK-UPS

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

.2 Construct in locations acceptable to the Contract Administrator and as specified in specific Section.

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

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.2 WATER SUPPLY

.1 The City will make available, for the extent that it is available, a supply of potable water for construction use at no charge to the Contractor

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

.3 Provide hoses, lines, connections, and other ancillary hardware which may be required.

.4 Return services to their original condition at the temporary locations.

.1 Leave in an altered condition only as approved by The City.

1.3 TEMPORARY HEATING AND VENTILATION

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

.2 Construction heaters used inside building must be vented to outside or be flameless type.

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

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

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

.5 Ventilating:

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

.6 Permanent heating system of building, not to be used for heating.

.7 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform with applicable codes and standards.
.2 Enforce safe practices.
.3 Prevent abuse of services.
.4 Prevent damage to finishes.
.5 Vent direct-fired combustion units to outside.

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

1.4 TEMPORARY POWER AND LIGHT

.1 The City will make available, for the extent that it is available temporary power during construction for temporary lighting and operating of power tools to a maximum supply of 230 volts 30 amps.

.2 Connect to existing power supply in accordance with Canadian Electrical Code and provide meters and switching.

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

.4 Temporary power for equipment requiring in excess of that available on-site is responsibility of the Contractor.

.5 Provide and maintain temporary lighting throughout project.

1.5 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for cellular telephone for site superintendent.

1.6 FIRE PROTECTION

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

.1 Provide construction facilities in order to execute Work.

.2 Remove from site all such work after use.

.3 Repair damage to existing property caused by installation, use and removal of construction facilities.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International):

.1 CAN/CSA S269.2-16, Access scaffolding for construction purposes.

1.3 SUBMITTALS

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

.2 Where Manitoba Regulation 217/2006 requires scaffolds to be designed by a professional engineer:

.1 Submit shop drawings bearing the seal of professional engineer registered in the Province of Manitoba.

1.4 SCAFFOLDING

.1 Design scaffolding in accordance with Manitoba Regulation 217/2006 and CAN/CSA S269.2.

1.5 SITE STORAGE/LOADING

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

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

1.6 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not interfere with normal operations, access by tenants or the public, or disrupt performance of Work.

1.7 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

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

1.8 SANITARY FACILITIES

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

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

1.9 CLEAN-UP

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

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

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.2 HOARDING

.1 Barricade area under construction to prevent the general public from improper access.

.1 Erect temporary site enclosure around site using 1.8 m high pre-fabricated welded galvanized steel tube and wire mesh fence panels.

.2 Provide metal bottom brackets with weights or other means to secure in place.

.3 Provide locking top pins to secure fence sections together.

.4 Secure fencing to adjacent structure for continuity of compound.

.2 Provide protected covered walkways to building entrances at locations where active work overhead of entrances is ongoing.

.3 Repair surface coatings and/or finishes which are damaged by temporary hoardings and barricades.

.4 Provide adequate signage, fencing, etc. to inform the public of the work being undertaken.

1.3 DUST TIGHT SCREENS

.1 Provide dust tight screens 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.

1.4 FIRE ROUTES

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

1.5 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.

1.6 PROTECTION OF BUILDING FINISHES

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

.2 Protect fire alarm system from dust contamination.

.3 Provide necessary screens, covers, and hoardings.

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Within text of each specifications section, reference may be made to reference standards. Conform to these reference standards, in whole or in part as specifically requested in specifications.

.2 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

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

.4 The Cost for such testing will be borne by the Contractor or Supplier.

1.2 QUALITY

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

.2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

.3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

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

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

.6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify the Contract Administrator of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify the Contract Administrator at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Contract Administrator reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 STORAGE, HANDLING AND PROTECTION

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

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

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

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

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

.6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of the Contract Administrator.

.9 Touch-up damaged factory finished surfaces to the Contract Administrator’s satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 TRANSPORTATION

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

1.6 MANUFACTURER'S INSTRUCTIONS

.1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

.2 Notify the Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that the Contract Administrator will establish course of action. Where conflicts exist, the more stringent instruction will be enforced.

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

1.7 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify the Contract Administrator if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. the Contract Administrator reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with the Contract Administrator, whose decision is final.

1.8 CO-ORDINATION

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

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

1.9 REMEDIAL WORK

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

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

1.10 PROTECTION OF WORK IN PROGRESS

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

1.11 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

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

.2 Remove waste materials from site at daily regularly scheduled times. Do not burn waste materials on site.

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

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

.5 Dispose of waste materials and debris off site.

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

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

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

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

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

1.2 FINAL CLEANING

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

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

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

.4 Remove waste products and debris other than that caused by The City or other Contractors.

.5 Remove waste materials from site at regularly scheduled times. Do not burn waste materials on site.

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

.7 Remove stains, spots, marks and dirt from existing surfaces, fixtures, and finishes within the work area or affected by the affected by the Work.

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

.9 Remove dirt and other disfiguration from exterior surfaces.

.10 Sweep and power wash clean all work areas.

.11 Remove construction debris from drains and pits.

.12 Mechanically clean all drain lines throughout the Crawlspace.

.13 Inspect and clean fire alarm components within crawlspace at completion of Work.

.1 Retain a fire alarm company to clean fire alarm components.

.1 Approved fire alarm cleaning companies:

.1 Cambridge Security, Fire Division (Fire-Tech).

.2 Vipond Inc.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 General Conditions C12.

.2 Supplemental Conditions D17.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Conduct the following in addition to requirements outlined in General Conditions C12 and Supplemental Conditions D17.

.2 Acceptance of Work Procedures:

.1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify the Contract Administrator in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.

.2 Request the Contract Administrator 's inspection.

.2 Contract Administrator 's Inspection:

.1 Contract Administrator and Contractor to inspect Work and identify defects and deficiencies.

.2 Contractor to correct Work as directed.

.3 Completion Tasks: submit written certificates that tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents.

.2 Defects: corrected and deficiencies completed.

.3 Work: complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by the Contract Administrator, and Contractor.

.2 When Work incomplete according to the Contract Administrator, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: when the Contract Administrator considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

.6 Commencement of Lien and Warranty Periods: date of The City’s acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.7 Final Payment:

.1 When the Contract Administrator considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.

.2 Refer to General Conditions C12: when Work deemed incomplete by the Contract Administrator, complete outstanding items and request re-inspection.

.8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.3 FINAL CLEANING

.1 Clean in accordance with Section 01 74 11 – Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Operation and maintenance data.

.2 As-built drawings, samples, and specifications.

.3 Product data, materials and finishes, and related information.

.4 Record documents.

.5 Equipment and systems.

.6 Spare parts, special tools and maintenance materials.

.7 Warranties and bonds.

1.2 SUBMISSION

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

.2 Copy will be returned after final inspection, with the Contract Administrator’s comments.

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

.4 Two weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, four final copies of operating and maintenance manuals in English.

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

.6 If requested, furnish evidence as to type, source and quality of products provided.

.7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.8 Pay costs of transportation.

1.3 OPERATION AND MAINTENANCE MANUAL FORMAT

.1 Organize data in the form of an 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. Identify contents of each binder on spine.

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

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

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

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

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

1.4 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;

- .1 date of submission;
- .2 names, addresses, and telephone numbers of the Contract Administrator and Contractor with name of responsible parties; and
- .3 schedule of products and systems, indexed to content of volume.

.2 For each product or system, list names, addresses and telephone numbers of Subcontractors and Suppliers, including local source of supplies and replacement parts.

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

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

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

1.5 AS-BUILT DOCUMENTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site for the Contract Administrator one record copy of:

- .1 Contract Drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Change Orders and other modifications to the Contract.
- .5 Reviewed shop drawings, product data, and samples.
- .6 Field test records.
- .7 Inspection certificates.
- .8 Manufacturer's certificates.

.2 Store as-built documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label as-built documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "AS-BUILT DOCUMENTS" in neat, large, printed letters.

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

.5 Keep as-built documents and samples available for inspection by the Contract Administrator.

1.6 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, and in a copy of the Project Manual, provided by the Contract Administrator.

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

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

.4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:

.1 Measured depths of sump pits.
.2 Measured horizontal, vertical, and slope locations of drainage piping.
.3 Field changes of dimension and detail.
.4 Changes made by change orders.
.5 Details not on original Contract Drawings.
.6 References to related shop drawings and modifications.

.5 Specifications: legibly mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.7 RECORD DOCUMENTS

.1 Prior to Substantial Performance of the Work, electronically transfer the marked up information from the as-built documents to a master set of drawing and specification files provided by the Contract Administrator, as follows:

.1 Drawings: AutoCAD Release 2017.
.2 Specifications: Bluebeam 2019.

.2 Mark revised documents as "RECORD DOCUMENTS". Include all revisions, with special emphasis on mechanical, electrical, concrete repairs, and crawlspace drainage.

.3 Employ a competent computer draftsperson to indicate changes on the electronic set of record drawings. Provide updated record drawings in AutoCAD Release 2017.

.4 Employ a competent specification writer to indicate changes to the electronic set of record specifications. Provide updated record specifications in Bluebeam 2019.

.5 Submit completed record documents to the Contract Administrator on a CD-ROM.

1.8 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's 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 Additional requirements: As specified in individual specification sections.

1.9 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Additional Requirements: as specified in individual specifications sections.

1.10 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to the Place of the Work; place and store.

.4 Receive and catalogue all items. Submit inventory listing to the Contract Administrator. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered Products and submit prior to final payment.

1.11 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to the Place of the Work; place and store.

.4 Receive and catalogue all items. Submit inventory listing to the Contract Administrator. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered Products and submit prior to final payment.

1.12 SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to the Place of the Work; place and store.

.4 Receive and catalogue all items. Submit inventory listing to the Contract Administrator. Include approved listings in Maintenance Manual.

1.13 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

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

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged Products at own expense.

1.14 WARRANTIES AND BONDS

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List Subcontractor, Supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by Subcontractors, Suppliers, and manufacturers, within ten days after completion of the applicable item of work.

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

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittal.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Methods and procedures for deconstruction of structures and parts of structures.

1.2 REFERENCES

.1 Workplace Safety and Health Act (C.C.S.M. c. W210):

.1 Regulation 217/2006, Workplace Safety and Health Regulation.

1.3 MEASUREMENT PROCEDURE

.1 No measurement will be made under this section for demolition. Include costs in item of work for which demolishing is required.

.2 Concrete Slab Scanning – Unit Price:

.1 Scan existing concrete structures for embedded electrical conduit at locations identified by the Contract Administrator as a unit price item.

.2 Unit prices are to include:

.1 Supervision, labour and materials, and equipment.

.2 Scanning and identification of embedded electrical conduit.

.3 Unit Prices:

.1 Scanning for embedded electrical conduit:

.1 Maximum area of 9 s.f. per scan

.1 Unit of measure: per 9 square foot (S.F.) scan.

.2 The minimum area of payment will be one 9 S.F. scan.

1.4 SUBMITTALS

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

1.5 QUALIFICATIONS

.1 Train workers and subcontractors to carry out work in accordance with appropriate deconstruction techniques.

.2 Project supervisor to have previous deconstruction experience and must be present on site throughout project.

1.6 SITE CONDITIONS

.1 Hazardous Materials

.1 Should material resembling asbestos or other hazardous material be encountered, stop work, take preventative measures, and notify the Contract Administrator immediately.

.1 Do not proceed until written instructions have been received from the Contract Administrator.

.2 Notify the Contract Administrator before disrupting building access or services.

.2 Existing Conditions:

.1 Ensure that materials, equipment and procedures safely supporting existing structure and construction live loads; that allow work to be accomplished and that minimize risk of damage to historic and archaeological elements.

.2 Ensure equipment and stockpiling of material do not exceed the structural capacity of the supporting structure.

.3 Protection:

.1 Protect existing structures and services designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of the Contract Administrator and at no cost to The City.

.2 In all circumstances ensure that demolition work does not adversely affect adjacent areas and operations below the parking deck.

.3 Do not dispose of waste of volatile materials such as, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout the project.

.4 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.

.5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities.

.9 Prevent movement, settlement or damage of adjacent structures, services. Provide bracing, shoring as required. Repair damage caused by deconstruction as directed by the Contract Administrator.

.10 Support affected structures and, if safety of structure being deconstructed appears to be endangered, take preventative measures. Cease operations and immediately notify the Contract Administrator.

.11 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems.

1.7 EXISTING UTILITIES

.1 Locate and protect any utility lines which may be affected by the work and if necessary, notify utility companies before starting demolition.

.2 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants.

.3 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

1.8 EMBEDDED ELECTRICAL CONDUIT

.1 When the presence of embedded electrical conduits are known:

.1 Prior to demolition ensure circuits feeding conduit within repair areas are disconnected, de-energized, or abandon.

.2 Coordinate shutdowns with The City.

.2 When the presence of embedded electrical conduits is unknown or are known but locations cannot be determined:

.1 Prior to demolition of concrete, scan existing concrete structures for embedded electrical conduit.

.2 Ensure circuits feeding conduit within repair areas are disconnected, de-energized, or abandon.

.3 Coordinate shutdowns with The City.

.4 Costs of scanning to be included as a unit rate item.

Part 2 Products

2.1 EQUIPMENT

.1 Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.

.2 Where possible use water efficient wetting equipment/attachments when minimizing dust.

.3 Demonstrate that tools are being used in manner which allows for salvage of materials in best condition possible.

Part 3 Execution

3.1 EXAMINATION

.1 Before starting work, verify existing conditions and variations. Notify the Contract Administrator of discrepancies.

.2 Conduct inspection with the Contract Administrator to determine extent of demolition.

.3 Locate and protect utilities. Preserve active utilities traversing site in operating condition.

.4 Notify and obtain approval of utility companies before starting demolition.

3.2 PREPARATION

.1 Remove items adjacent to area of demolition to provide clear workspace. Store in area designated by the Contract Administrator.

.2 Take pre-demolition photographs of Work Area prior to demolition.

3.3 DISASSEMBLY

.1 Conduct demolition to minimize interference with adjacent building areas maintain protected, wheelchair accessible egress and access at all times to the building entrance.

.2 Progressively remove debris created by the execution of the work from the site to appropriate disposal grounds. Do not damage adjacent finishes or surfaces.

.3 Do not disturb adjacent items designated to remain in place.

.4 Remove and store reusable site materials and dismantle items containing materials for salvage and stockpile salvaged materials at locations as approved by the Contract Administrator.

.5 Ensure workers and subcontractors are briefed and trained to carry out work in accordance with appropriate deconstruction techniques.

.6 Project supervisor with previous deconstruction experience must be present on site throughout project.

.7 Deconstruct in accordance with Regulation 217/2006 and other applicable safety standards.

3.4 REMOVAL FROM SITE

.1 Transport material designated for disposal to approved facilities in accordance with applicable regulations.

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

3.5 CLEANING AND RESTORATION

.1 Keep site clean and organized throughout deconstruction.

.2 Upon completion of project, remove debris, trim surfaces and leave work site clean.

.3 Upon completion of project, reinstate parking surfaces, walkways, affected by Work to condition which existed prior to beginning of Work and match condition of adjacent, undisturbed areas.

.4 In addition to the progressive removal of waste materials and debris from building and site, leave the site clean, perform the following before final inspection by the Contract Administrator.

.1 Spray-wash all exterior building finishes in construction area and any adjacent building areas soiled by the construction processes.

.2 Broom clean and wash exterior walks, steps and platforms soiled from delivery or removal materials.

.3 Remove all dirt and other disfigurations from exterior surfaces.

.4 Sweep clean all paved areas.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CSA-O86-14, Engineering Design in Wood.
- .3 CSA O121-17, Douglas Fir Plywood.
- .4 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.
- .5 CSA S269.1-16, Falsework and Formwork.

1.2 MEASUREMENT PROCEDURES

.1 No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework is required.

Part 2 Products

2.1 MATERIALS

.1 Formwork materials:

- .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, CSA O437 Series, and CSA-O153.
- .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.

.2 Form ties:

- .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
- .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.

.3 Form release agent: non-toxic, biodegradable.

.4 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.

.5 Falsework materials: to CSA-S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

.1 Fabricate and erect falsework in accordance with CSA S269.1.

.2 Refer to drawings for concrete members requiring architectural exposed finishes.

.3 Do not place shores and mud sills on frozen ground.

.4 Provide site drainage to prevent washout of soil supporting mud sills and shores.

.5 Fabricate and erect formwork in accordance with CAN/CSA-S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.

.6 Align form joints and make watertight. Keep form joints to minimum.

.7 Use 1 inch (25 mm) chamfer strips on external corners and/or 1 inch (25 mm) fillets at interior corners, joints, unless specified otherwise.

.8 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.9 Construct forms for architectural concrete, and place ties as indicated.

.1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

.10 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.

.1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

.11 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

.1 Leave formwork in place for following minimum periods of time after placing concrete.

.1 Structural slab repairs: Three (3) days or the time it takes to reach 70% of the 28 day design strength, whichever is greater.

.2 Through-slab repairs: Three (3) days or the time it takes to reach 70% of the 28 day design strength, whichever is greater.

.3 Vertical grouting repairs: Three (3) or the time it takes to reach 20 MPa, whichever is greater.

.4 Vertical Form and Pour repairs: Three (3) or the time it takes to reach 20 MPa, whichever is greater.

.5 Miscellaneous curbs, pads, etc.: One (1) day.

.2 Remove formwork when concrete has reached 70 % of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

.3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.

.4 Space reshoring in each principal direction at not more than 8’ apart.

.5 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Concrete reinforcing and dowels to complete concrete repairs as shown on Drawings and as supplemental to that shown on Drawings as directed by the Contract Administrator under Base Price and Unit Price components.

1.2 RELATED SECTIONS

.1 Section 03 92 12 – Top Surface Repairs with Rapid Setting Mortar.

.2 Section 03 93 10 – Hand Patching.

.3 Section 03 93 20 – Pressure Grouting.

1.3 REFERENCES

.1 ASTM International

.1 ASTM A143/A143M-07(2014), Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.

.2 ASTM A775/A775M-17, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

.3 ASTM A1064 / A1064M - 18a, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

.2 CSA International

.1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A23.3-14, Design of Concrete Structures.

.3 CSA-G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement.

.4 CSA-G40.20/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.5 CAN/CSA-G164-18, Hot Dip Galvanizing of Irregularly Shaped Articles.

.6 CSA W186-M1990(R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.

.3 Reinforcing Steel Institute of Canada (RSIC)

.4 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.4 MEASUREMENT PROCEDURES

.1 No measurement will be required for:

.1 Reinforcing and dowels as shown on details for lump sum Work and for designated concrete unit price repairs where location, size and quantity of reinforcing is shown on details. Reinforcing steel and dowel costs to be included in the lump sum tender amount and unit price concrete repair to which they pertain.

.2 Where the Contract Administrator directs supplemental reinforcing and dowels in addition to that shown on details:

.1 Measure reinforcing steel in kilograms of steel incorporated into Work, computed from theoretical unit mass specified in CSA-G30.18 for lengths and sizes of bars as indicated or authorized in writing by the Contract Administrator.

.2 Dowels will be measured individually and will include dowel drilling, cleaning, preparation, epoxy supply and placement, and bar insertion, but excluding steel costs which will be covered by the rate per kilogram unit prices. The Contract Administrator and the Contractor will count and agree upon the numbers and lengths of bars as well as the number of bar embedments. These agreed upon number will form the basis for payment.

.3 These unit prices will only cover supplemental reinforcing steel and dowels in addition to that shown on concrete repair details as designated by the Contract Administrator. All other reinforcing steel and dowel costs must be included in the lump sum tender amount and unit price components of the work to which they correspond.

1.5 SUBMITTALS

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

.2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba.

.1 Indicate placing of reinforcement and:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

.4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by the Contract Administrator, with identifying code marks to permit correct placement without reference to structural drawings.

.5 Indicate sizes, spacings and locations of chairs, spacers and hangers.

.2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.

Part 2 Products

2.1 MATERIALS

.1 Substitute different size bars only if permitted in writing by the Contract Administrator.

.2 Reinforcing steel: All reinforcing steel to be CAN/CSA-G30.18M grade 400R deformed bars except column ties and beam stirrups which shall be grade 400W.

.3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.

.4 Cold-drawn annealed steel wire ties: to ASTM A1064/A1064M.

.5 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.

.6 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m².

.1 Protect galvanized reinforcing steel with chromate treatment to prevent reaction with Portland cement paste.

.2 If chromate treatment is carried out immediately after galvanizing, soak steel in aqueous solution containing minimum 0.2% by weight sodium dichromate or 0.2% chromic acid.

.1 Temperature of solution equal to or greater than 32 degrees and galvanized steels immersed for minimum 20 seconds.

.3 If galvanized steels are at ambient temperature, add sulphuric acid as bonding agent at concentration of 0.5% to 1%.

.1 In this case, no restriction applies to temperature of solution.

.1 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

.2 Mechanical splices: subject to approval of the Contract Administrator.

.3 Plain round bars: to CSA-G40.20/G40.21.

.4 Dowel Adhesive:

.1 Use only approved adhesive to manufacturer's instructions.

.2 Acceptable products:

.1 Hilti HIT HY-200 by Hilti Canada.

.2 Sika Anchorfix 3001 by Sika Canada.

.3 Substitutions will be considered in accordance with General Conditions B7.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Obtain the Contract Administrator's written approval for locations of reinforcement splices other than those shown on placing drawings.

.3 Upon approval of the Contract Administrator, weld reinforcement in accordance with CSA W186.

2.3 SOURCE QUALITY CONTROL

.1 Upon request, provide the Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.

.2 Upon request inform the Contract Administrator of proposed source of material to be supplied.

Part 3 Execution

3.1 PREPARATION

.1 Galvanizing to include chromate treatment.

.1 Duration of treatment to be 1 hour per 25 mm of bar diameter.

.2 Upon request, conduct bending tests to verify galvanized bar fragility in accordance with ASTM A143/A143M.

3.2 FIELD BENDING

.1 Do not field bend or field weld reinforcement except where indicated or authorized by the contract Administrator.

.2 When field bending is authorized, bend without heat, applying slow and steady pressure.

.3 Replace bars, which develop cracks or splits.

3.3 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.

.2 Prior to placing concrete, obtain the Contract Administrator approval of reinforcing material and placement.

.3 Ensure cover to reinforcement is maintained during concrete pour.

3.4 DOWELING PROCEDURES

.1 For bars that are indicated as being dowelled, drill in and grout bars into slab as follows:

- .1 10M bars, 6 inches.
- .2 15M bars, 8 inches.
- .3 20M bars, 12 inches.

.2 Clean hole thoroughly prior to application of adhesive. Use injection or caulking gun to ensure that the adhesive fills the bottom of the hole prior to embedment of bar.

3.5 FIELD TOUCH-UP

.1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Work of this section includes the supply, placing and finishing of a cast-in-place light duty concrete mixture on the crawlspace floor as shown on Drawings.

1.2 RELATED SECTIONS

.1 Section 03 10 00 – Concrete Forming and Accessories.

.2 Section 03 20 00 – Concrete Reinforcing.

.3 Section 07 26 00 – Vapour Retarders.

1.3 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA-A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CAN/CSA-A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)

.3 CSA A283-19, Qualification Code for Concrete Testing Laboratories.

.2 American Concrete Institute (ACI)

.1 ACI 309R-05, Guide for the Consolidation of Concrete.

.3 American Society for Testing and Materials International (ASTM)

.1 ASTM C260/C260M-10a(2016), Specification for Air-Entraining Admixtures for Concrete.

.2 ASTM C309-19, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.3 ASTM C494/C494M-19 Standard Specification for Chemical Admixtures for Concrete.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

1.4 MEASUREMENT PROCEDURES

.1 No measurement will be made under this section for cast-in-place concrete identified as lump sum base bid work.

1.5 CERTIFICATES

.1 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

.2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

.3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1. Certification letter to be sealed by an engineer registered in the Province of Manitoba.

1.6 QUALITY ASSURANCE

.1 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures for review by Contract Administrator on following items:

.1 Falsework erection.
.2 Hot weather concrete.
.3 Cold weather concrete.
.4 Curing.
.5 Finishes.
.6 Formwork removal.
.7 Joints.

1.7 ABBREVIATIONS

.1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).

.1 Type GU or GUb - General use cement.
.2 Type CI - with CaO content ranging from 8 to 20%.

.2 SCM – Supplemental cementing materials.

.3 SSD - Saturated surface dry.

.4 WRA – Water reducing agent.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.

.1 Modifications to maximum time limit must be agreed to Contract Administrator and concrete producer as described in CSA A23.1/A23.2.
.2 Deviations to be submitted for review by Contract Administrator.

.2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products

2.1 MATERIALS

.1 The concrete constituents shall comply with the following standards:

.1 Cement: to CAN/CSA-A3001.
.2 Blended Hydraulic cement: to CAN/CSA-A3001.
.3 Supplementary cementing materials: to CAN/CSA-A3001.
.4 Water: To CSA-A23.1.
.5 Aggregates: to CSA-A23.1. Coarse aggregates to be normal density.
.6 Air entraining admixture: ASTM C260.

.7 Chemical admixtures: ASTM C494/C494M. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather.

2.2 MIX REQUIREMENTS

.1 Proportion normal density concrete in accordance with CSA-A23.1, Table 5, Alternative 1 to obtain the following performance:

.1 Type 1: Slab on Grade:

.1 Class of exposure: C-2

.2 Minimum compressive strength at 28 days: 32 MPa.

.3 Air category: 1 (5 to 8%)

.4 Nominal size of coarse aggregate: 20 mm.

.5 Slump at point of discharge: consistent with placement and consolidation methods, equipment, and site conditions and as approved by Contract Administrator.

2.3 ACCESSORIES

.1 Evaporation retardant:

.1 Acceptable Product:

.1 MasterKure ER 50, formerly (Confilm) by BASF Building Systems at a minimum application rate of 4.9 m²/L.

.2 Substitutions will be considered in accordance with General Conditions B7.

.2 Cure and sealing compound: to ASTM C309, Type 1.

.1 Acceptable product(s):

.1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m²/L.

.2 MasterKure CC, formerly (Kure-N-Seal) by BASF Building Systems at a minimum application rate of 4.9 m²/L.

.3 Substitutions will be considered in accordance with General Conditions B7.

.3 Vapour Barrier: In accordance with Section 07 26 00 – Vapour Retarders.

2.4 GRANULAR BASE

.1 Comply with Section 31 23 00 – Excavation and Fill.

Part 3 Execution

3.1 PREPARATION

.1 Obtain Contract Administrator 's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.

.2 Ensure reinforcement and inserts are not disturbed during concrete placement.

.3 Prior to placing of concrete obtain Contract Administrator 's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.4 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.5 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and epoxy grout to anchor and hold dowels in positions as indicated. Refer to Section 03 20 00.

.6 Do not place load upon new concrete until authorized by Contract Administrator.

.7 Provide formwork and falsework to Section 03 10 00 - Concrete Forms and Accessories.

.8 Place reinforcing steel and install dowels to Section 03 20 00 - Concrete Reinforcement. Provide dowels at locations shown on the drawings.

.9 Obtain Contract Administrator 's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.

.10 Prior to placing of concrete obtain Contract Administrator 's approval of proposed method for protection of concrete during placing and curing in adverse weather. Protection and curing must comply with the hot weather and cold weather requirements of CSA-A23.1.

.11 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.12 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and epoxy grout to anchor and hold dowels in positions as indicated.

.13 Provide temporary bridging as required to permit access to all areas during placement, finishing and curing.

.14 Do not place concrete until screed rails for hand operated strike-off devices are in place and firmly secured.

.1 Rails to be of type, and so installed, that no springing or deflection will occur due to weight of finishing equipment.

.2 Set rails or headers to elevations to produce deck true to required grade and cross section.

.3 Use polyethylene film or plastic coated tape if necessary to prevent concrete from bonding to rails.

.4 Do not treat rails with release agents or parting compounds.

.5 Subject to approval of the Contract Administrator, screed rail anchors which remain in the concrete may be used provided they are non-corroding and sit a minimum of 30 mm below the finished surface of the concrete.

3.2 MIX PRODUCTION

.1 Concrete to be mixed, delivered and placed in accordance with CSA A23.1.

.2 Concrete to be batched and mixed at a ready mix plant and delivered to site in ready to place form.

.3 Control of slump on the job site to be in accordance with CSA-A23.1 except as otherwise specified below:

.1 The addition of water to increase slump is strictly prohibited unless prior written permission from concrete supplier is obtained.

.2 The use of WRA may be required to aid in placement of the concrete and obtain adequate consolidation in heavily reinforced sections.

.3 WRA addition shall occur at the batch plant or on site. For site addition, concrete supplier to provide written notice minimum 2 weeks prior to commencement of

concrete work, indicating recommended dosages based on slump at point of discharge.

.4 Site addition WRA will be the responsibility of the concrete supplier.

.5 Slump and air must be measured both before and after addition of WRA.

3.3 PLACEMENT

.1 Place concrete work in accordance with CSA-A23.1.

.2 Concrete shall be transported to placement location by pump or trolley. Note that regard to load limitations on the deck must be maintained to avoid overstressing the structural members.

.3 When concrete is placed by pump, the initial slurry used to prime the pump shall not be incorporated into the topping. The slurry shall be trapped and disposed off-site.

.4 Ensure high points and slopes to drains as shown on drawings are maintained.

.5 Pour concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur. Install a construction dam or bulkhead in case of a delay longer than 60 minutes. During delays between 5 and 60 minutes, protect the end of the placement with damp burlap.

.6 Protect freshly placed concrete from exposure to dust, debris and precipitation.

.7 Sleeves and inserts.

.1 No sleeves, ducts, pipes or other openings shall pass through concrete members except where indicated or approved by Contract Administrator.

.2 Electrical conduits, junction and fixture boxes shall not be embedded within concrete members.

.3 Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Contract Administrator.

.4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Contract Administrator before placing of concrete.

.5 Check locations and sizes of sleeves and openings shown on drawings.

.6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.

3.4 FINISHING

.1 Finish concrete in accordance with CSA-A23.1/A23.2.

.2 Consolidate concrete in accordance with CSA A23.1 and ACI 309.

.3 Under adverse conditions only, excess bleed water may be removed from the surface using procedures acceptable to Contract Administrator and those noted in CSA-A23.1. Ensure surface is not damaged.

.4 Immediately after final finishing apply approved evaporation retardant at indicated coverage rate. Evaporation retardant is not to be applied during finishing operations nor should it be worked into the surface.

.5 Unless otherwise indicated round edges of formed joints in pavements with a 10 mm radius edging tool.

.6 Flatwork:

.1 Continuously consolidate and finish to specified elevations, ensuring thickness and required elevations are maintained.

.2 Use of a floating vibratory screed to consolidate the top surface of the concrete will be mandatory.

.1 The use of screed rails may be required to meet required surface tolerances.

.2 Move vibrating screed forward as rapidly as possible while allowing proper consolidation and finishing of the concrete surface. Extended use of a vibratory screed may result in segregation of the concrete producing excessive mortar at the surface which can result in a weak surface layer.

.3 Immediately after concrete has been placed and consolidated, bull-float slab surface to a smooth uniform surface.

.4 When the surface is sufficiently set to accommodate the weight of a person with only minor indentation of the surface, and all bleed water has evaporated, **use one pass of a power float surface to smooth out the surface**. A light hand trowel will then be necessary to smooth out irregularities and provide a hard, dense surface.

.5 Use of hand trowels will be required to hand finish areas the finishing machine cannot reach.

.6 Surface free of all trowel marks and ridges.

.7 Schedule of finishes:

.1 Concrete pavement, and exposed curbs subject to foot or vehicular traffic:

.1 Class A to CSA A23.1.

.2 Texture: Non-slip broomed.

3.5 JOINTS

.1 Install control joints at locations shown on the drawings. Joints shall correspond to location of slip dowels.

.2 Location of control and construction joints:

.1 Concrete pavements: As shown on Drawings.

.2 Other flatwork not shown on drawings: not more than 15’ on-centre and matching joints in adjacent work.

.3 Control joints in upstand walls and curbs to be formed matching joints in adjacent work (no more that 15’ on-centre) and using a 1/2” x 1/2” form strip on each face. Tool in joints along top surface corresponding to form strips.

.3 Control joints and construction joints shall be formed or tooled at locations shown. Refer to Drawings for paving patterns and joint locations.

.1 All joints to be sawcut via specialized dry-process cutting.

.1 Sawcut to a minimum of one 1.5” or one-quarter of the depth of the slab, whichever is greater, following initial set of concrete.

.2 Timing of the saw cutting will vary with weather conditions however are typically completed within 1 to 4 hours after final finishing. Timing of the saw cutting will be the responsibility of the Contractor. Sawcutting 24 hours following placement will not be permitted.

.4 Where paving abuts curbs, walls and other vertical surfaces use 12 mm asphalt impregnated fibre board.

.5 Unless otherwise indicated, all control and construction joints to be filled with a flexible joint sealant.

3.6 CURING

.1 Cure and protect concrete in accordance with requirements CSA A23.1.

.2 Concrete surfaces to be cured at a minimum temperature of 10°C for the entire curing period.

.3 Curing methods shall be in accordance with CSA A23.1 unless otherwise indicated.

.1 Basic curing methods shall consist of one of the following:

.1 polyethylene sheet;

.2 forms in contact with concrete surface; or

.3 curing compounds to ASTM C309 at manufacturer's specified applications rates, when approved by Contract Administrator.

.2 Requirements for wet-curing:

.1 Immediately after final finishing, protect exposed surface against plastic shrinkage by means of a fog spray and/or evaporation reducer, until the concrete has enough strength to support the placement of the wetted burlap. When an evaporation reducer is used, intermittent reapplication may be required if the film evaporates before initiation of the wet cure.

.2 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.

.3 Commence wet curing with burlap and water as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one layer with strips overlapping at least 75 mm and be securely held in place without marring the concrete surface.

.4 Wet curing with burlap and water must be maintained for the periods indicated. Periodic rewetting by means of a soaker hoses, sprinklers, or other suitable methods approved by the Contract Administrator may be necessary.

.4 Curing Schedule:

.1 Structural concrete work, curbs, etc.

.1 7d at ≥ 10°C and for time necessary to attain 70% of the specified strength with a **wet-curing period of not less than 4d**.

.2 Concrete paving slabs, slabs-on-grade, sidewalks, and exposed curbs subject to foot or vehicular traffic:

.1 7d at ≥ 10°C and for time necessary to attain 70% of the specified strength with a **wet-curing period of not less than 3d** followed by the application of a cure and sealing compound.

.5 Unless noted otherwise the curing regime shall be consistent with the Class of Exposure. Refer to related sections for curing of concrete repair materials.

3.7 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Contract Administrator in accordance with CSA-A23.1 and Section 01450 - Quality Control and as described herein.

.1 Testing laboratory to be certified in accordance with CSA A283.

.2 The Contractor will pay for costs of tests as a unit price.

.3 Frequency and Number of Tests:

.1 Not less than one strength test per 50 m^3 of concrete placed and not less than one test for each class of concrete placed on any one day.

.2 Slump and air measurements will be completed on each of the initial 3 loads of concrete per day of casting to ensure satisfactory control of the air content is established. If adequate control of air content is not established within the first 3 loads of concrete or if a test falls outside the specified limits, the testing frequency shall revert to one test per load until satisfactory control is re-established. Costs for additional testing will be the responsibility of the concrete supplier.

.4 Contract Administrator may take additional test cylinders during cold weather concreting or when concrete quality is suspect. Cure cylinders on job site under same conditions as concrete which they represent.

.5 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.2.

.6 Inspection or testing by Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

3.8 DEFECTIVE CONCRETE

.1 Defective concrete: cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.

.2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.

.3 Do not patch, fill, touch-up, repair or replace exposed concrete except upon express direction of Contract Administrator for each individual use.

.4 Modify or replace concrete not conforming to lines, detail and elevations indicated on drawings.

.5 Repair or replace concrete not properly placed, resulting in excessive honeycombing and other defects in critical areas of stress.

.6 Notify Contract Administrator of proposed methods of repairing or replacing defective concrete. Methods of repairing or replacing defective concrete shall be acceptable to the Contract Administrator.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Removal of deteriorated concrete and surface preparation for the repair of deteriorated concrete resulting from reinforcing steel corrosion and is applicable to horizontal, vertical, and overhead repairs.

.2 All delaminated or deteriorated concrete must be removed down to sound concrete. The reinforcing may have to be exposed at these locations by removing additional concrete, if there is any sign of corrosion. All concrete and exposed reinforcing shall be cleaned of all corrosion by mechanical means.

1.2 RELATED SECTIONS

.1 Section 03 20 00 – Concrete Reinforcing.

.2 Section 03 93 10 – Hand Patching

.3 Section 03 93 20 – Pressure Grouting

1.3 MEASUREMENT PROCEDURES

.1 Concrete areas of repair will be identified and quantified via soundings completed by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and the Contract Administrator prior to commencement of work.

.2 Refer to applicable Sections for measurement procedures for each type of repair.

1.4 REFERENCES

.1 American Concrete Institute (ACI)

.1 ACI 546-04, Concrete Repair Guide.
.2 ACI RAP-5, Surface Repair Using Form-and-Pump Techniques.
.3 ACI RAP-7, Spall Repair of Horizontal Concrete Surfaces.
.4 ACI RAP-3, Spall Repair by Low-Pressure Spraying.
.5 ACI RAP-4, Surface Repair Using Form-and-Pour Techniques.
.6 ACI RAP-6, Vertical and Overhead Spall Repair by Hand Application.
.7 ACI RAP-9, Spall Repair by the Preplaced Aggregate Method.

.2 Canadian Standards Association (CSA)

.1 CSA- S448.1-10, Repair of Reinforced Concrete in Buildings.

.3 International Concrete Repair Institute (ICRI)

.1 ICRI concrete Repair Terminology (2010 Edition).
.2 ICRI Guideline No. 120.1–2009, Guidelines and Recommendations for Safety in the Concrete Repair Industry.
.3 ICRI Guideline No. 130.1R–2009, Guide for Methods of Measurement and Contract Types for Concrete Repair Work (formerly No. 03735).
.4 ICRI Guideline No. 310.1R–2008, Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion (formerly No. 03730).

.5 ICRI Guideline No. 310.2R–2, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.5 DEFINITIONS

.1 Delamination: A separation along a plane parallel to a surface as in the separation of a coating from a substrate or the layers of a coating from each other, or in the case of a concrete slab, a horizontal splitting, cracking, or separation of a slab in a plane roughly parallel to, and generally near, the upper surface.

.2 Laitance: A weak layer of cement and aggregate fines on a concrete surface that is usually caused by an overwet mixture, overworking the mixture or excessive finishing, underwater concrete placement, or combinations thereof.

.3 Sounding: A technique to evaluate the condition of hardened concrete by striking the surface with a hammer; sound concrete will exhibit a clear ringing sound, whereas dull or hollow sounds indicate delaminated areas.

.4 Spall: A fragment, usually in the shape of a flake, detached from a larger mass by a blow, by the action of weather, by pressure, or by expansion within the larger mass; a small spall involves a roughly circular depression not greater than 120 mm in depth and 150 mm in any dimension; a large spall, may be roughly circular or oval or in some cases elongated, is more than 20 mm in depth and 150 mm in greatest dimension

.5 Substrate: The layer immediately under a layer of different material to which it is typically bonded; an existing concrete surface that receives an overlay, partial-depth repair, protective coating, or some other maintenance or repair procedure.

.6 Surface Preparation: The process whereby a method or combination of methods is used to remove deteriorated or contaminated concrete and roughen and clean a substrate to enhance bond of a repair material or protective coating.

.7 Surface Profile: The topographic contour of the exposed surface of a material or substrate.

1.6 SUBMITTALS

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

.2 Qualification Statements:

.1 Contractor Qualifications Statement:

.1 Provide minimum 5 examples of local projects demonstrating successful performance concrete repairs of similar size and complexity to specified Work within the last 3 years.

.2 Provide minimum 3 references exhibiting successful performance concrete repairs within the last 3 years.

.2 Site Superintendent Qualification Statement:

.1 Provide minimum 5 examples of local projects demonstrating successful performance as site superintendent of concrete repairs of similar size and complexity to specified Work within the last 3 years.

.2 Provide minimum 3 references exhibiting successful performance as site superintendent of concrete repairs within the last 5 years.

1.7 QUALITY ASSURANCE

.1 Contractor Qualifications:

.1 Minimum of 5 years experience in the repair and restoration of concrete structures.

.2 Site Superintendent to have a minimum of 5 years experience exhibiting successful performance in concrete restoration projects.

.3 Ensure all personnel involved with concrete restoration is adequately trained and familiar with the requirements of this Section.

.2 Field Mock-ups:

.1 Complete a field mock-up for each type of repair. Locations to be site determined.

.2 Field mock-up shall be a minimum of 2 sq.ft. and incorporate all aspects of the concrete surface preparation described in this Section. Trial repairs areas shall be chosen to include exposure of embedded reinforcing steel.

.3 Field mock-up areas shall be used as a standard against which subsequent work shall be judged.

Part 2 Products

2.1 EQUIPMENT

.1 Electric or pneumatic chipping hammers are to be used for demolition within the following limits:

.1 Initial bulk removal of delaminated concrete above corroded reinforcing steel: maximum 30 lb. electric or pneumatic chipping hammers.

.2 Final removal and undercutting of reinforcing steel: maximum 15 lb. electric chipping hammers.

.3 Bulk removal of full depth repairs: electric or pneumatic jack hammers with weight ratings above 30 lbs. may be used upon approval by the Contract Administrator.

.4 Chisel-type blades are to be used for removal only. Do not use pointed chisels for removal.

.2 Sandblast equipment shall consist of:

.1 Air compressor of sufficient capacity to drive the equipment and blast media selected.

.2 Blast media hopper (meters the media into the air stream passing through the hose and nozzle).

.3 Moisture and oil separators to insure clean, dry air supply.

.4 Blast nozzle and hose.

.5 Materials. The blast medium consistent with equipment, site conditions, and capable of obtaining specified surface profile.

.3 High pressure waterblast: capable of maintaining a sustained pressure of not less than 4,000 psi.

Part 3 Execution

3.1 EXAMINATION

.1 The location number and extent of repairs shown on Drawings are indicative only. Repairs areas will be identified on-site by the Contract Administrator in the presence of and with the assistance of the Contractor. The approximately periphery of the repair will

be marked on the surface of the member and the location and extent recorded on drawings

.2 Allow time in the Schedule for survey and inspection work carried out by the Contract Administrator ahead of repairs. Provide sufficient safe access to enable review of all areas designated for repairs.

.3 The Contractor shall make available as required throughout the Contract labour to carry out the following under the direction of the Contract Administrator:

.1 Identification of repairs.
.2 Sample chipping and/or drilling.
.3 Operators for access equipment.

.4 The Contractor shall make available as required throughout the Contract equipment for the use of the Contract Administrator:

.1 Marking paint and chalk.
.2 Hammer and chain for sounding surveys.
.3 Tape measure.

3.2 PREPARATION

.1 All necessary measures shall be taken to provide protection to the general public, occupants of the building.

.2 Remove or protect all surface attachments (e.g. signs, notices, electrical fittings) from the areas to be repaired or from positions that obstruct access or which may be damaged from Work.

.3 Carefully store items removed during the course of the works. Reinstall when restoration work is complete.

.4 Protect building materials, fixtures and equipment below and adjacent to repair areas from damage.

.5 The Contractor shall make good or rectify any damage caused as a result of insufficient protection.

.6 Provide temporary access required to facilitate Work.

.7 The perimeter of the through-slab must be adequately shored. The perimeter of the through-slab must be adequately shored. The Contractor is responsible for confirmation of shoring requirements prior to commencement of, and during demolition.

.1 Costs of shoring to be included in the unit price.

3.3 CONCRETE DELAMINATION REMOVAL

.1 Remove all loose and or delaminated concrete above corroded reinforcing steel.

.2 Do not operate hammers or mechanical chipping tools at an angle in excess of 45° measured from the surface of the slab.

.3 Use chipping to extend concrete removal along reinforcing bars and ensure bars are completely free of corrosion and well bonded to the surrounding concrete. Notify the Contract Administrator of increases in areas.

.4 Where the bond between existing concrete and reinforcing steel or mesh has been destroyed (either by the concrete's deterioration or corrosion of the reinforcing steel) or if the chipping operation has caused more than 1/3 the periphery of a bar to be exposed for a distance of 6 inches (150 mm) or more, the concrete adjacent to the bar shall be removed by maximum 15 lb. electric chipping hammers to provide sufficient clearance between the reinforcement and concrete.

.1 Provide a minimum 3/4 inches (20 mm) clearance, or 1/4 inch (6 mm) larger than the largest aggregate in the repair material, whichever is greater.

.5 If non-corroded reinforcing steel is exposed, do not damage the bar’s bond to the surrounding concrete. If bond between the bar and concrete is destroyed, exposing the bar will be required.

.6 The perimeter of the areas marked as delaminated are to be saw cut to a depth of 1/2 inch (12 mm). Feather edging is not permitted. If reinforcing steel is encountered, the saw depth must be immediately reduced as required. Check depth of the cut regularly.

.7 Ensure sawcut encompasses the boundaries of corrosion that have been established.

.8 Ensure the entire area within the saw cut is removed to a depth consistent with the type of repair and repair material specified in other Sections.

.9 Chip patch edges to provide a clean vertical edge along the patch perimeter to the required minimum depth.

.10 Conduct soundings to determine if any further unsound or delaminated concrete is present, which must be removed.

.11 After all delaminated, unsound, or loose material is removed, the Contractor shall request an inspection from the Contract Administrator. This inspection is to be completed in the presence of the Contractor and if any further Work is required, the Contractor is to complete it immediately. The purpose of this inspection is to provide assurance to the Contract Administrator that all loose material has been removed and the substrate is sound.

3.4 SURFACE PREPARATION OF CONCRETE AND REINFORCING STEEL

.1 Within 24 hours prior to infilling, sandblast the substrate to remove loose and deteriorated concrete, laitance, dust, dirt, oil, and any other material that could interfere with the bond of the new concrete. Provide a uniform surface profile of ICRI-CSP-10 or better. Sample surfaces are available for inspection in the Contract Administrator 's office. These samples will be used as the standard of acceptance.

.2 Surface preparation applies equally to any horizontal or vertical concrete surfaces to which the concrete is to bond.

.3 Exposed reinforcing steel to be cleaned to near white metal and totally free of rust for the full circumference of the bar.

.4 Secure any reinforcement which is loose by tying to other secured bars or by other methods approved by the Contract Administrator.

.5 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.

.6 Maintain substrate in a clean condition using polyethylene film until the patch material is ready to be placed.

.7 After all surface preparation is complete the Contractor shall request an inspection from the Contract Administrator to review the existing reinforcing steel. The purpose of this inspection is to provide assurance that all heavy corrosion and scale is removed from the bar. At that time, the Contract Administrator will review the condition of the reinforcing steel and determine if the addition of supplemental reinforcing steel will be required. At locations identified by the Contract Administrator, provide supplemental reinforcing steel to Section 03 20 00.

.8 Final cleaning of the concrete substrate shall consist of a high pressure waterblast substrate at minimum 4,000 psi to remove any residual dust and dirt.

.9 Maintain substrate in a saturated condition for a period of not less than 8 hours prior to infilling. Do not allow the concrete surface to dry. If the concrete surface becomes wet and subsequently dries, the surface preparation and cleaning procedure must be repeated.

3.5 FIELD QUALITY CONTROL

.1 Coordinate site work and inspections with the Contract Administrator. Provide minimum 24 hours notice prior to each phase of the work.

.2 The Contract Administrator inspection to be completed at the following times:

.1 Prior to demolition to identify and quantify repair locations and types.

.2 Following initial demolition to confirm all loose, deteriorated, or unsound concrete has been removed from the substrate.

.3 Following concrete substrate preparation to review concrete surface profile and condition of reinforcing steel.

.3 Direct pull-out tensile tests of the substrate will be completed in accordance with CSA-A23.2-6B throughout the course of the work but not less than the following:

.1 Prior to demolition, a minimum of three (3) direct tensile tests shall be conducted. The purpose of the testing is to provide an estimate of the insitu tensile strength of the concrete substrate. Test locations should correspond to locations which appear visibly sound as determined by hammer and chain drag soundings. Locations will be chosen by the Contract Administrator.

.1 Test locations will be chosen by the Contract Administrator which will correspond to locations which appear sound as determined by hammer and chain drag soundings.

.2 After demolition, minimum three (3) tests will be completed for each type of repair for every 100 sq.ft. of repair area.

.1 Where possible, test locations will be will be completed within a 5-‘0’ radius of the pre-demolition samples for comparison. Otherwise, test locations will be chosen by the Contract Administrator.

.3 The tensile strength after completion of the surface preparation must be within 70% of the tests prior to demolition but not less than 1.0 MPa.

.4 The Contract Administrator reserves the right to take additional tests if concrete substrate is suspect.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 The top surface of slabs exhibiting extensive spalling and/or delamination are to be repaired by mechanical removal of the deteriorated concrete and infilling with a rapid-setting mortar.

.2 All spalling and/or delaminated concrete must be removed down to sound concrete in accordance with Section 03 91 10.

1.2 RELATED SECTIONS

.1 Section 03 10 00 – Concrete Formwork and Accessories.

.2 Section 03 91 10 – Surface Preparation for Concrete Delamination Repairs.

1.3 MEASUREMENT PROCEDURES

.1 Repair areas will be handled as a unit price repair.

.2 Repair areas will be identified and quantified via hammer soundings by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and the Contract Administrator prior to commencement of work.

.3 Unit prices are to include:

- .1 Supervision, labour and materials, and equipment.
- .2 Shoring as required.
- .3 Reinforcing as shown on Drawing details.

.4 If the area of the repair is increased over that originally measured without consultation with the Contract Administrator, then the Contractor will not be paid for the increased area.

.5 Unit Prices:

- .1 Full depth concrete slab repair:
  - .1 Removal and infill of entire slab thickness through slab repair.
    - .1 Unit of measure: per square foot (S.F.)
    - .2 Minimum payment for repair areas will be 1 S.F.
- .2 Top surface repair – 0” to 3” deep:
  - .1 Removal and infill depths of up to 3 inches and at no point less than 1 inches in depth.
    - .1 Unit of measure: per square foot (S.F.).
    - .2 The minimum area of payment will be one (1) S.F.
- .3 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Contract Administrator in accordance with CSA-A23.1.
  - .1 Unit of measure: per specimen.
  - .2 Minimum payment for testing will be 1 specimen.

1.4 REFERENCES

.1 American Concrete Institute (ACI)

.1 ACI 546-04, Concrete Repair Guide.

.2 ACI RAP-7, Spall Repair of Horizontal Concrete Surfaces.

.2 Canadian Standards Association (CSA)

.1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.3 American Society for Testing and Materials (ASTM)

.1 ASTM C39 / C39M – 20, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

.2 ASTM C109 / C109M - 16a, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).

.3 ASTM C191 – 19, Standard Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle.

.4 ASTM C309-11, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.5 ASTM C496 / C496M – 17, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.

.6 ASTM C666 / C666M – 15, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.

.7 ASTM C672 / C672M – 12, Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.

.8 ASTM C928 / C928M – 20, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.

.9 ASTM C1202 – 19, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.

.4 International Concrete Repair Institute

.1 ICRI concrete Repair Terminology (2010 Edition).

.2 ICRI Guideline No. 120.1–2009, Guidelines and Recommendations for Safety in the Concrete Repair Industry.

.3 ICRI Guideline No. 130.1R–2009, Guide for Methods of Measurement and Contract Types for Concrete Repair Work (formerly No. 03735).

1.5 SUBMITTALS

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

.2 Qualification Statements:

.1 Provide references of successful completion of a minimum of 5 projects of similar size and complexity to specified Work within the last 3 years.

1.6 QUALITY ASSURANCE

.1 Contractor Qualifications:

.1 Minimum of 5 years experience in application of specified (or similar) products on projects of similar size and scope.

.2 Successful completion of a minimum of 5 projects of similar size and complexity to specified Work within the last 3 years.

.2 Field Mock-up:

.1 Install field mock-up at Project site or pre-selected area of building or location approved by the Contract Administrator. Install material in accordance with this Section.

.2 Field mock-up will be standard for judging workmanship on remainder of Project.

.3 Manufacturer's representative or designated representative will review technical aspects; surface preparation, repair, and workmanship.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Comply with Section 01 61 00.

.2 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

.3 Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.

.4 Keep materials in manufacturer's original, unopened containers and packaging until installation.

.5 Protect materials during storage, handling, and application to prevent contamination or damage.

1.8 PROJECT CONDITIONS

.1 Environmental Requirements:

.1 Ensure that substrate surface and ambient air temperature are minimum of 4°C and rising at application time and remain above 4°C for at least 24 hours after application. Ensure that frost or frozen surfaces are thawed and dry.

.2 Ensure that substrate surface and ambient air temperature are below of 32°C and remain below 32°C for at least 8 hours after application.

.3 Do not apply material if snow, rain, fog, and mist are anticipated within 12 hours after application. Allow surfaces to attain temperature and conditions specified before proceeding with application.

Part 2 Products

2.1 MATERIALS

.1 Rapid Setting Repair Mortar: One-component, shrinkage-compensated, cement-based mortar with extended working time for repairing horizontal concrete surfaces.

.1 Provide mortar material complying with the following requirements:

.1 Compliance: ASTM C928.

.2 Compressive Strength, ASTM C109, 2-inch (51-mm) cubes:

.1 3 Hours: 3,000 psi (21 MPa).

.2 1 Day: 6,000 psi (41 MPa).

.3 28 Days: 8,000 psi (55 MPa).

.3 Compressive Strength, ASTM C39, 3-inch by 6-inch (76-mm by 152-mm) cylinders:

.1 28 Days: 7,400 psi (51 MPa).

.4 Set Time, ASTM C191, 72 degrees F (22 degrees C):

.1 Initial: 50 minutes.

.2 Final: 80 minutes.

.5 Splitting Tensile Strength, ASTM C496:

.1 1 Day: 400 psi (3 MPa).

.2 28 Days: 450 psi (3 MPa).

.6 Freeze-Thaw Resistance, ASTM C666, Procedure A, at 300 cycles:

.1 100 percent relative dynamic modulus.

.7 Scaling Resistance, ASTM C672, at 25 cycles:

.1 Zero rating; no scaling.

.8 Length Change, ASTM C928:

.1 Drying Shrinkage: Minus 0.05 percent.

.2 Wetting Expansion: Plus 0.03 percent.

.9 Rapid Chloride Permeability, ASTM C1202:

.1 Less than 300 Coulombs.

.10 Coefficient of Thermal Expansion, CRD C39:

.1 6.8×10^{-6} in/in/degree F (12.6×10^{-6} cm/cm/degree C).

.2 Acceptable Product:

.1 MasterEmaco T 1061 formerly (10-61 Rapid Mortar) by BASF Building Systems.

.2 Substitutions will be considered in accordance with Bidding Procedures B7 - Substitutes.

2.2 ACCESSORIES

.1 Aggregate Extension: extend mortar material with washed, graded, 3/8 inch (10 mm), low-absorption, saturated surface-dry aggregate at mortar manufacturers recommended rates.

.1 For repair areas 2” – 4" (50 – 100 mm) in depth, the minimum recommended addition is 15 – 25 lbs (6.8 – 11.4 kg) of 3/8" (10 mm) washed, graded, rounded, SSD, low-absorption, high-density aggregate per 50 lb (22.7 kg) bag.

.2 For areas greater than 4" (100 mm) in depth, the minimum recommended addition is 25 – 50 lbs (11.4 – 22.7 kg) of 3/8" (10 mm) washed, graded, rounded, SSD, low-absorption, high-density aggregate per 50 lb bag.

.3 The maximum aggregate extension is 50 lbs (22.7 kg) of pea gravel per bag.

.2 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):

.1 Acceptable products:

.1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m²/L.

.2 MasterKure CC 160 WB, formerly(Kure-N-Seal WB) by BASF Building Systems at a minimum application rate of 4.9 m²/L.

.3 Substitutions will be considered in accordance with Bidding Procedures B7 - Substitutes.

Part 3 Execution

3.1 PREPARATION

.1 Protection: Protect adjacent Work areas and finish surfaces from damage during repair mortar application.

.2 Surface Preparation:

.1 Complete concrete delamination repairs to 03 91 10 – Surface Preparation for Concrete Delamination Repairs.

.3 The repair area must be thoroughly cleaned and well soaked prior to infilling. The surface should be thoroughly wetted for a period of not less than two (2) hours. The repair areas shall be kept continuously wet until just before infilling. Any standing water must be removed prior to grouting.

.4 Maintain the substrate in a saturated, surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.

.5 Obtain the Contract Administrator's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.

.6 Through slab repair forming:

.1 Provide formwork in accordance with Section 03 10 00 – Concrete Forming and Accessories to match existing profiles.

.2 Design and install formwork and shoring to accommodate the mass and pressure of the repair material.

.3 Securely anchor formwork to substrate. Anchors to be sized and space to prevent deflection of the forms placement and curing.

.4 Construct forms to fit tightly against existing concrete surfaces. Seal around edge of formwork with sealant to prevent leakage during grouting.

.5 Anchors:

.1 Completely removable.

.2 Patch anchor holes with grout mixed to dry pack consistency.

.3 Completely fill all anchor holes.

.6 A minimum of 30 mm concrete cover over the primary reinforcing steel will be required, thus, an adjustment of the formwork such as a notch may be required to ensure sufficient cover.

.7 Provide drainage outlets in formwork for presoaking and, if beneath a soffit, provide air venting. Provide suitable access points to pour mixed repair mortar into place.

.8 Use form-release agent to facilitate removal of forms from cast material.

.9 Within two (2) hours immediately prior to placement of repair material, test formwork to determine watertightness. Completely fill formwork with clean water and let stand for not less than 15 minutes. Any areas of leakage are to be sealed prior to placement of repair material. Re-test as required.

3.2 INFILLING PROCEDURES

.1 Obtain the Contract Administrator's approval before placing repair material. Provide minimum 24 hours notice.

.2 Maintain the substrate in a saturated surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.

.3 Mixing of rapid-setting mortar and horizontal extended mortar:

.1 Mix materials in accordance with manufacturer’s instructions.

.2 Ensure repair mortar is thoroughly mixed.

.3 Do not use free-fall mixers.

.4 Never mix partial bags.

.4 Bonding Slurry Application:

.1 Apply the bonding slurry consisting of neat rapid-setting mortar to a saturated surface dry (SSD) substrate with no standing water and dry to the touch. A SSD substrate typically exhibits a colour change of dark grey to light grey. Remove standing water by vacuuming.

.2 Scrub plastic slurry into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8” over entire area.

.3 Place repair material while the bonding slurry is still plastic. Do not apply more slurry than can be covered with concrete before it dries. Do not retemper. If the bond slurry dries prior to placement of the concrete, removal of the dried slurry will be required. The concrete substrate will then be cleaned and prepared in accordance with the requirements described in the previous sections.

.5 Immediately place repair material, into the prepared patch area from one side to the other. Work the repair material firmly into the bottom and sides of the patch, and underneath reinforcing steel, to assure good bond.

.6 Ensure that rate of placing is sufficient to complete proposed placing, finishing and curing operations within scheduled time. Limit batch sizes as required if placing procedures are slower than anticipated.

.7 Continuously consolidate and finish to matching elevations, ensuring patch thickness and required elevations are maintained.

.8 Ensure reinforcement, floor drains, inserts, etc. are not disturbed during concrete placement.

3.3 FINISHING

.1 Following consolidation and screeding, the surface shall be immediately bull-floated to close and smooth the surface to match existing.

.2 Apply evaporation retardant at manufacturers recommended coverage rate immediately following final finishing. Do not apply evaporation retardant during any finishing operation nor should it be worked into the surface.

.3 Protect freshly placed concrete from exposure to dust, debris and precipitation.

3.4 CURING

.1 Concrete repairs to be cured for a minimum of 3 days at 10°C.

.2 Immediately after final finishing, apply evaporation retardant to prevent drying shrinkage until the concrete has enough strength to support the placement of the wet burlap.

.3 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.

.4 Commence wet curing as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one layer with strips overlapping at least 3” and be securely held in place without marring the concrete surface.

.5 Wet curing with burlap and water must be maintained throughout entire curing period.

.6 Workers shall not be allowed on the overlay for 12 hours after placement. Do not place load upon new concrete until curing period is over.

3.5 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Contract Administrator in accordance with CSA-A23.1 and Section 01 45 00 - Quality Control and as described herein.

.2 The Contractor will pay for costs of tests as a unit price item.

.3 Inspection or testing by the Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

3.6 DEFECTIVE CONCRETE

.1 Defective concrete: bond strengths below minimum specified value, cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, finishes or specified requirements.

.2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.

.3 Do not patch, fill, touch up, repair or replace exposed concrete except upon express direction of the Contract Administrator for each individual use.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This section covers the removal and replacement of scaled surface areas the structural deck to provide a smooth surface for installation of the membrane.

.2 The scaling will be removed with a bush hammer and subsequently infilled with thin patching compound. Topping shall be removed and replaced using the same material, extended with aggregate.

1.2 RELATED SECTIONS

.1 Section 03 91 10 – Surface Preparation for Concrete Delamination Repair.

1.3 MEASUREMENT PROCEDURES

.1 Repair areas will be handled as a unit price repair.

.2 Repair areas will be identified and quantified via hammer soundings by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and the Contract Administrator prior to commencement of work.

.3 Unit prices are to include:

.1 Supervision, labour and materials, and equipment.
.2 Shoring as required.
.3 Reinforcing as shown on Drawing details.

.4 If the area of the repair is increased over that originally measured without consultation with the Contract Administrator, then the Contractor will not be paid for the increased area.

.5 Unit Prices:

.1 Scaling repair – 0” to 1” deep:
.1 Removal and infill depths of up to 1 inch in depth.
.1 Unit of measure: per square foot (S.F.).
.2 The minimum area of payment will be one (1) S.F.

.2 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Contract Administrator in accordance with CSA-A23.1.
.1 Unit of measure: per specimen.
.2 Minimum payment for testing will be 1 specimen.

1.4 REFERENCES

.1 American Concrete Institute (ACI)

.1 ACI 546-04, Concrete Repair Guide.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM C109 / C109M - 16a, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).

.2 ASTM C266 – 18, Standard Test Method for Time of Setting of Hydraulic-Cement Paste by Gillmore Needles.

.3

.4 ASTM C309-11, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.5 ASTM C348 – 20, Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.

.6 ASTM C469 / C469M – 14, Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression.

.7 ASTM C496 / C496M – 17, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.

.8 ASTM C666 / C666M – 15, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.

.9 ASTM C672 / C672M – 12, Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.

.10 ASTM C882 / C882M – 20, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.

.11 ASTM C928 / C928M – 20, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.

.12 ASTM C1202 – 19, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.

.3 Canadian Standards Association (CSA)

.1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.4 International Concrete Repair Institute

.1 ICRI concrete Repair Terminology (2010 Edition).

.2 ICRI Guideline No. 120.1–2009, Guidelines and Recommendations for Safety in the Concrete Repair Industry.

.3 ICRI Guideline No. 130.1R–2009, Guide for Methods of Measurement and Contract Types for Concrete Repair Work (formerly No. 03735).

1.5 SUBMITTALS

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

.2 Qualification Statements:

.1 Provide references of successful completion of a minimum of 5 projects of similar size and complexity to specified Work within the last 3 years.

1.6 QUALITY ASSURANCE

.1 Contractor Qualifications:

.1 Minimum of 5 years experience in application of specified (or similar) products on projects of similar size and scope.

.2 Successful completion of a minimum of 5 projects of similar size and complexity to specified Work within the last 3 years.

.2 Field Mock-up:

.1 Install field mock-up at Project site or pre-selected area of building or location approved by the Contract Administrator. Install material in accordance with this Section.

.2 Field mock-up will be standard for judging workmanship on remainder of Project.

.3 Manufacturer's representative or designated representative will review technical aspects; surface preparation, repair, and workmanship.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Comply with Section 01 61 00.

.2 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

.3 Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.

.4 Keep materials in manufacturer's original, unopened containers and packaging until installation.

.5 Protect materials during storage, handling, and application to prevent contamination or damage.

1.8 PROJECT CONDITIONS

.1 Environmental Requirements:

.1 Ensure that substrate surface and ambient air temperature are minimum of 4°C and rising at application time and remain above 4°C for at least 24 hours after application. Ensure that frost or frozen surfaces are thawed and dry.

.2 Ensure that substrate surface and ambient air temperature are below of 32°C and remain below 32°C for at least 8 hours after application.

.3 Do not apply material if snow, rain, fog, and mist are anticipated within 12 hours after application. Allow surfaces to attain temperature and conditions specified before proceeding with application.

Part 2 Products

2.1 MATERIALS

.1 One-component high-performance, cementitious mortar that produces high-early strength and contains modified cement, aggregate, and additives meeting the following performance requirements:

.1 Properties

.1 Complies with ASTM C928.

.2 Compressive Strength, ASTM C109:

.1 3 Hour: minimum 6 MPa

.2 1 Day: minimum 30 MPa.

.3 7 Days: minimum 50 MPa.

.3 Set Time, ASTM C266, minimum 21°C:

.1 Initial: 75 minutes or less

.2 Final: 90 minutes or less.

.4 Flexural Strength, ASTM C348:

.1 1 Day: minimum 4 MPa.

.2 7 Days: minimum 6 MPa.

.5 Modulus of Elasticity at 28 days, ASTM C469: 35 ± 5 GPa.

.6 Splitting Tensile Strength, ASTM C496:

.1 1 Day: minimum 3.5 MPa.

.2 7 Days: minimum 7.5 MPa.

.7 Slant Shear Bond Strength, ASTM C882 Modified:

.1 1 Day: minimum 12 MPa.

.2 7 Days: minimum 20 MPa.

.8 Rapid chloride permeability, AASHTO-T277/ASTM C1202: less than 1,000 coulombs.

.9 Scaling Resistance (weight loss, lb/ft²), ASTM C672:

.1 25 cycles: CaCl2: 0.003, NaCl: 0.067

.2 50 cycles: CaCl2: 0.005, NaCl: 0.084

.10 Freeze-Thaw Resistance, ASTM C666, (Procedure A) 100% Relative Dynamic Modulus at 300 cycles: 98.5.

.2 Acceptable product:

.1 MasterEmaco T 430, (formerly Emaco T-430) by BASF Building Systems.

.2 Substitutions will be considered in accordance with Bidding Procedures B7 - Substitutes.

2.2 ACCESSORIES

.1 Evaporation retardant: MasterKure ER 50, (formerly Confilm) by BASF Building Systems at a minimum application rate of 4.9 m²/L.

.2 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):

.1 Acceptable products:

.1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m²/L.

.2 MasterKure CC 160 WB, formerly(Kure-N-Seal WB) by BASF Building Systems at a minimum application rate of 4.9 m²/L.

.3 Substitutions will be considered in accordance with Bidding Procedures B7 - Substitutes.

Part 3 Execution

3.1 SCALING REMOVAL PROCEDURES

.1 The Contract Administrator will mark out the perimeter of the scaled or debonded areas, which are to be removed as specified herein.

.2 The Contractor must saw-cut the perimeter of the scaled repair area to ¼" using wet cut methods. Removal of the scaled material shall be accomplished by the use of a short stroke electric chipping hammer with a sharp bush hammer bit to remove the surface scaling within the marked-out areas.

.3 Minimum depth of removal will be ¼", and maximum depth will be 1" for scaling repairs.

.4 Once the areas have been bush hammered, the Contractor must chain drag all areas to determine if any further unsound material is present, which must be removed.

.5 Once the areas are determined by the Contractor to be sound, request a final inspection from the Contract Administrator. This inspection shall be done in the presence of the Contractor, who shall complete any further work at the time of the inspection.

.6 Within 24 hours prior to infilling, shotblast the substrate to remove loose and deteriorated concrete, laitance, dust, dirt, oil, and any other material that could interfere with the bond of the new concrete. Provide a uniform surface profile of ICRI-CSP-5 or better. Sample surfaces are available for inspection in the Contract Administrator 's office. These samples will be used as the standard of acceptance.

.7 Vacuum clean surface and/or air blast with oil free compressed air to remove residue and spent media created by surface preparation.

.8 Maintain substrate in a clean condition using polyethylene film until the overlay is ready to be placed.

3.2 INFILL PROCEDURE

.1 Obtain the Contract Administrator's approval before placing repair material. Provide minimum 24 hours notice.

.2 Maintain the substrate in a saturated surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.

.3 Mixing of rapid-setting horizontal mortar:

.1 Mix materials in accordance with manufacturer’s instructions.

.2 Ensure repair mortar is thoroughly mixed.

.3 Do not use free-fall mixers.

.4 Never mix partial bags.

.4 Bonding Slurry Application:

.1 Apply the bonding slurry consisting of neat rapid-setting mortar to a saturated surface dry (SSD) substrate with no standing water and dry to the touch. A SSD substrate typically exhibits a colour change of dark grey to light grey. Remove standing water by vacuuming.

.2 Scrub plastic slurry into substrate with stiff bristled broom or brush to produce a uniform thickness of 1/8” over entire area.

.3 Place repair material while the bonding slurry is still plastic. Do not apply more slurry than can be covered with concrete before it dries. Do not re-temper. If the bond slurry dries prior to placement of the concrete, removal of the dried slurry will be required. The concrete substrate will then be cleaned and prepared in accordance with the requirements described in the previous sections.

.5 Immediately place repair material, into the prepared patch area from one side to the other. Work the repair material firmly into the bottom and sides of the patch, and underneath reinforcing steel, to assure good bond.

.6 Ensure that rate of placing is sufficient to complete proposed placing, finishing and curing operations within scheduled time. Limit batch sizes as required if placing procedures are slower than anticipated.

.7 Continuously consolidate and finish to matching elevations, ensuring patch thickness and required elevations are maintained.

.8 Ensure reinforcement, floor drains, inserts, etc. are not disturbed during concrete placement.

3.3 FINISHING

.1 Following consolidation and screeding, the surface shall be immediately bull-floated to close and smooth the surface to match existing.

.2 Apply evaporation retardant at manufacturers recommended coverage rate immediately following final finishing. Do not apply evaporation retardant during any finishing operation nor should it be worked into the surface.

.3 Protect freshly placed concrete from exposure to dust, debris and precipitation.

3.4 CURING

.1 Concrete repairs to be cured for a minimum of 3 days at 10°C.

.2 Immediately after final finishing, apply evaporation retardant to prevent drying shrinkage until the concrete has enough strength to support the placement of the wet burlap.

.3 Burlap to be thoroughly presoaked by immersing it in water for a period of at least 24 hours immediately prior to placement.

.4 Commence wet curing as soon as the surface will support the weight of the wetted burlap without deformation. Burlap to be applied in one layer with strips overlapping at least 3" and be securely held in place without marring the concrete surface.

.5 Wet curing with burlap and water must be maintained throughout entire curing period.

.6 Workers shall not be allowed on the overlay for 12 hours after placement. Do not place load upon new concrete until curing period is over.

3.5 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Contract Administrator in accordance with CSA-A23.1 and Section 01 45 00 - Quality Control and as described herein.

.2 The Contractor will pay for costs of tests as a unit price item.

.3 Not less than one test per 50 square feet of patching material placed and not less than one test for each day of placement.

.1 Test samples to be prepared by a CSA certified laboratory in accordance with ASTM C109.

3.6 DEFECTIVE CONCRETE

.1 Defective concrete: bond strengths below minimum specified value, cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, finishes or specified requirements.

.2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.

.3 Do not patch, fill, touch up, repair or replace exposed concrete except upon express direction of the Contract Administrator for each individual use.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Slab soffit areas, beams, columns, and walls exhibiting extensive spalling and/or delamination requiring localized repairs less than 2" in depth will be repaired by removing the deteriorated concrete, cleaning and preparing the substrate, and patching the area with a cementitious patching material

1.2 RELATED SECTIONS

.1 Section 03 20 00 – Concrete Reinforcing.

.2 Section 03 91 10 – Surface Preparation for Concrete Delamination Repairs.

.3 Section 03 93 20 – Pressure Grouting.

1.3 MEASUREMENT PROCEDURES

.1 Repair areas will be handled as a unit price repair.

.2 Repair areas will be identified and quantified via hammer soundings by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and the Contract Administrator prior to commencement of work.

.3 Unit prices are to include:

- .1 Supervision, labour and materials, and equipment.
- .2 Shoring as required.
- .3 Reinforcing as shown on Drawing details.

.4 If the area of the repair is increased over that originally measured without consultation with the Contract Administrator, then the Contractor will not be paid for the increased area.

.5 Unit Prices:

- .1 Hand patching concrete repairs – 0” to 1” deep:
  - .1 Apply to removal depths of up to 2 inches and at no point less than 1/2 inch in depth.
    - .1 Unit of measure: per square foot (S.F.).
    - .2 The minimum area of payment will be one 1/2 S.F.
  - .2 Repairs over 1 inch in depth will be repaired via pressure grouting in accordance with Section 03 93 20.
- .2 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Contract Administrator in accordance with CSA-A23.1.
  - .1 Unit of measure: per specimen.
  - .2 Minimum payment for testing will be 1 specimen.
- .3 Direct pull-out tensile tests to determine bond strength of concrete repair.
  - .1 Unit of measure: per test location.
  - .2 Minimum payment for testing will be 1 test location.

1.4 REFERENCES

.1 American Concrete Institute (ACI)

.1 ACI 546-04, Concrete Repair Guide.

.2 ACI RAP-6, Vertical and Overhead Spall Repair by Hand Application.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM C109 / C109M - 16a, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).

.2 ASTM C157 / C157M – 17, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.

.3 ASTM C309-11, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.4 ASTM C469 / C469M – 14, Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression.

.5 ASTM C666 / C666M – 15, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.

.6 ASTM C672 / C672M – 12, Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.

.3 Canadian Standards Association (CSA)

.1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.4 International Concrete Repair Institute (ICRI)

.1 ICRI concrete Repair Terminology (2010 Edition).

.2 ICRI Guideline No. 120.1–2009, Guidelines and Recommendations for Safety in the Concrete Repair Industry.

.3 ICRI Guideline No. 130.1R–2009, Guide for Methods of Measurement and Contract Types for Concrete Repair Work (formerly No. 03735).

1.5 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 – Submittals.

.2 Qualification Statements:

.1 Provide references of successful completion of a minimum of 5 projects of similar size and complexity to specified Work within the last 3 years.

1.6 QUALITY ASSURANCE

.1 Contractor Qualifications:

.1 Minimum of 5 years experience in application of specified (or similar) products on projects of similar size and scope.

.2 Successful completion of a minimum of 5 projects of similar size and complexity to specified Work within the last 3 years.

.2 Field Mock-up:

.1 Install field mock-up at Project site or pre-selected area of building or location approved by the Contract Administrator. Install material in accordance with this Section.

.2 Field mock-up will be standard for judging workmanship on remainder of Project.

.3 Manufacturer's representative or designated representative will review technical aspects; surface preparation, repair, and workmanship.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Comply with Section 01 61 00.

.2 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

.3 Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.

.4 Keep materials in manufacturer's original, unopened containers and packaging until installation.

.5 Protect materials during storage, handling, and application to prevent contamination or damage.

1.8 PROJECT CONDITIONS

.1 Environmental Requirements:

.1 Ensure that substrate surface and ambient air temperature are minimum of 4°C and rising at application time and remain above 4°C for at least 24 hours after application. Ensure that frost or frozen surfaces are thawed and dry.

.2 Ensure that substrate surface and ambient air temperature are below of 32°C and remain below 32°C for at least 8 hours after application.

.3 Do not apply material if snow, rain, fog, and mist are anticipated within 12 hours after application. Allow surfaces to attain temperature and conditions specified before proceeding with application.

Part 2 Products

2.1 MATERIALS

.1 Patching Mortar: Infilling with a one-component, thixotropic, rheoplastic, cement-based, fiber-reinforced, shrinkage-compensated, sulfate-resistant structural repair mortar.

.1 Drying shrinkage to ASTM C157:
  .1 less than 0.10% at 28 days.

.2 Compressive Strength to ASTM C109:
  .1 Minimum 7 MPa at 3 hours.
  .2 Minimum 21 MPa at 1 day.
  .3 Minimum 28 MPa at 7 days.

.3 Modulus of elasticity to ASTM C469:
  .1 $25x10^3$ MPa ± $10x10^3$ MPa.

.4 Freeze/Thaw Resistance to ASTM C 666, Procedure A:
  .1 Minimum 96.0% RDM at 300 cycles.

.5 Salt Scale Resistance to ASTM C672:
  .1 Less than 0.05 kg/m² at 50 cycles.

.2 Acceptable product(s):

.1 MasterEmaco S 488 CI (formerly Emaco S88 CI) by BASF Building Systems.

.2 Planitop X by Mapei.

.3 Substitutions will be considered in accordance with Bidding Procedures B7 - Substitutes.

2.2 ACCESSORIES

.1 Evaporation retardant: MasterKure ER 50 (formerly Confilm) by BASF Building Systems at a minimum application rate of 4.9 m²/L.

.2 Cure and sealing compound: to ASTM C309, Type 1. Acceptable product(s):

.1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m²/L.

.2 MasterKure CC 160 WB formerly (Kure-N-Seal WB) by BASF Building Systems at a minimum application rate of 4.9 m²/L.

.3 Substitutions will be considered in accordance with Bidding Procedures B7 - Substitutes.

Part 3 Execution

3.1 PREPARATION

.1 Protection: Protect adjacent Work areas and finish surfaces from damage during repair mortar application.

.2 Surface Preparation:

.1 Complete concrete delamination repairs to 03 91 10 – Surface Preparation for Concrete Delamination Repairs.

.3 The repair area must be thoroughly cleaned and well soaked prior to infilling. The surface should be thoroughly wetted for a period of not less than two (2) hours. The repair areas shall be kept continuously wet until just before infilling. Any standing water must be removed prior to grouting.

.4 Maintain the substrate in a saturated, surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.

3.2 APPLICATION PROCEDURES

.1 Obtain the Contract Administrator's approval before placing repair material. Provide minimum 24 hours notice.

.2 The patch material must be installed and cured in strict accordance with manufacturer’s specifications.

.3 Apply repair mortar to a saturated surface dry (SSD) substrate with no standing water and dry to the touch. A SSD substrate typically exhibits a colour change of dark grey to light grey.

.4 Apply a bond slurry, consisting of neat patching mortar, to the prepared surface. Thoroughly scrub a thin layer of normal consistency mortar into the saturated surface with a stiff bristle brush to produce a uniform thickness of approximately 1/8” over entire area.

.5 Apply repair mortar by hand towelling on vertical or overhead surfaces in depths ranging from 1/2” to 2".

.1 Vertical Applications: Repair mortar can be applied on vertical applications up to a 2" depth per lift.

.2 Overhead Applications: Do not exceed 1.5" thickness per lift. For depths greater than 1.5", limit succeeding lifts to 1" thickness.

.3 Multiple Passes: Place succeeding lifts after repair mortar has developed initial set. Scarify the surface of the first lift to ensure integral bond between successive layers.

3.3 FINISHING

.1 Level surface of repair mortar using a float or screed.

.2 Apply final finish when mortar has begun to stiffen using a wooden, plastic, or synthetic sponge float or trowel.

.3 Spray apply undiluted evaporation reducer lightly to aid in finishing.

.4 Trim or shape to the desired profile if required.

3.4 CURING

.1 Protect fresh mortar from premature evaporation.

.2 Concrete repairs to be cured for a minimum of 7 days at 10°C. Provide supplemental heat and hoarding as required throughout curing period.

.1 Keep patch continuously moist with water for a minimum of 7 days.

.2 Apply two coats curing compound in accordance with manufacturer's specifications. Apply the first coat immediately upon removal of forms. Apply the second coat about 24 hours later.

3.5 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Contract Administrator in accordance with CSA-A23.1 and Section 01 45 00 - Quality Control and as described herein.

.2 The Contractor will pay for costs of tests via the testing cash allowance as per Section 01 2 10 - Allowances.

.3 Not less than one test per 50 square feet of patching material placed and not less than one test for each day of placement.

.1 Test samples to be prepared by a CSA certified laboratory in accordance with ASTM C109.

.4 Direct pull-out tensile tests to determine bond strength will be completed throughout the course of the work but not less than the following:

.1 Three (3) tests.

.2 The Contract Administrator reserves the right to take additional bond tests if concrete or bonding system is suspect.

.3 Infilling of the core hole will be the responsibility of the General Contractor. Unless otherwise directed by the Contract Administrator, repair in accordance with this Section.

.4 Test samples to be prepared by a CSA certified laboratory.

.5 Testing agency to submit copies of concrete test reports directly to The City and the Contract Administrator.

.6 Inspection or testing by the Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

3.6 DEFECTIVE CONCRETE

.1 Defective concrete: bond strengths below minimum specified value, cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, finishes or specified requirements.

.2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.

.3 Do not patch, fill, touch up, repair or replace exposed concrete except upon express direction of the Contract Administrator for each individual use.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Slab soffit areas, beams, columns and walls exhibiting extensive spalling and/or delamination in which patching would be uneconomical are to be repaired by mechanical removal of the deteriorated concrete and replacement with a pumpable grout.

.2 All spalling and/or delaminated concrete must be removed down to sound concrete in accordance with Section 03 91 10 - Surface Preparation for Concrete Delamination Repairs.

1.2 RELATED SECTIONS

.1 Section 03 20 00 – Concrete Reinforcing.

.2 Section 03 91 10 – Surface Preparation for Concrete Delamination Repairs.

.3 Section 03 93 10 – Hand Patching.

1.3 MEASUREMENT PROCEDURES

.1 Repair areas will be handled as a unit price repair.

.2 Repair areas will be identified and quantified via hammer soundings by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and the Contract Administrator prior to commencement of work.

.3 Unit prices are to include:

.1 Supervision, labour and materials, and equipment.
.2 Shoring as required.
.3 Reinforcing as shown on Drawing details.

.4 If the area of the repair is increased over that originally measured without consultation with the Contract Administrator, then the Contractor will not be paid for the increased area.

.5 Unit Prices:

.1 Pressure grout repair – 0” to 2” deep:
.1 Removal and infill depths of up to 2 inches and at no point less than 1 inches in depth.
.1 Unit of measure: per square foot (S.F.).
.2 The minimum area of payment will be one (1) S.F.

.2 Pressure grout repair – through slab:
.1 Removal and infill depths of up to 4 inches and at no point less than 2 inches in depth.
.1 Unit of measure: per square foot (S.F.).
.2 The minimum area of payment will be one (1) S.F.

.3 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Contract Administrator in accordance with CSA-A23.1.

.1 Unit of measure: per specimen.

.2 Minimum payment for testing will be 1 specimen.

.4 Direct pull-out tensile tests to determine bond strength of concrete repair.

.1 Unit of measure: per test location.

.2 Minimum payment for testing will be 1 test location.

1.4 REFERENCES

.1 American Concrete Institute (ACI)

.1 ACI 546-04, Concrete Repair Guide.

.2 ACI RAP-5, Surface Repair Using Form-and-Pump Techniques.

.2 American Society for Testing and Materials (ASTM)

.1 ASTM C109 / C109M - 16a, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).

.2 ASTM C157 / C157M – 17, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.

.3 ASTM C309-11, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

.4 ASTM C496 / C496M – 17, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.

.5 ASTM C531 – 18, Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

.6 ASTM C666 / C666M – 15, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.

.7 ASTM C882 / C882M - 13a, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.

.8 ASTM C1202 – 19, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.

.3 Canadian Standards Association (CSA)

.1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.4 International Concrete Repair Institute (ICRI)

.1 ICRI concrete Repair Terminology (2010 Edition).

.2 ICRI Guideline No. 120.1–2009, Guidelines and Recommendations for Safety in the Concrete Repair Industry.

.3 ICRI Guideline No. 130.1R–2009, Guide for Methods of Measurement and Contract Types for Concrete Repair Work (formerly No. 03735).

1.5 SUBMITTALS

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

.2 Qualification Statements:

.1 Provide references of successful completion of a minimum of 5 projects of similar size and complexity to specified Work within the last 3 years.

1.6 QUALITY ASSURANCE

.1 Contractor Qualifications:

.1 Minimum of 5 years experience in application of specified (or similar) products on projects of similar size and scope.

.2 Successful completion of a minimum of 5 projects of similar size and complexity to specified Work within the last 3 years.

.2 Field Mock-up:

.1 Install field mock-up at Project site or pre-selected area of building or location approved by the Contract Administrator. Install material in accordance with this Section.

.2 Field mock-up will be standard for judging workmanship on remainder of Project.

.3 Manufacturer's representative or designated representative will review technical aspects; surface preparation, repair, and workmanship.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Comply with Section 01 61 00 – Common Product Requirements.

.2 Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

.3 Store tightly sealed materials off ground and away from moisture, direct sunlight, extreme heat, and freezing temperatures.

.4 Keep materials in manufacturer's original, unopened containers and packaging until installation.

.5 Protect materials during storage, handling, and application to prevent contamination or damage.

1.8 PROJECT CONDITIONS

.1 Environmental Requirements:

.1 Ensure that substrate surface and ambient air temperature are minimum of 4°C and rising at application time and remain above 4°C for at least 24 hours after application. Ensure that frost or frozen surfaces are thawed and dry.

.2 Ensure that substrate surface and ambient air temperature are below of 32°C and remain below 32°C for at least 8 hours after application.

.3 Do not apply material if snow, rain, fog, and mist are anticipated within 12 hours after application. Allow surfaces to attain temperature and conditions specified before proceeding with application.

Part 2 Products

2.1 MATERIALS

.1 One-component, shrinkage-compensated, micro concrete consisting of cement, graded aggregate, shrinkage-compensating agents, and additives complying with the following performance requirements:

.1 Compressive Strength, ASTM C109:

.1 1 day: minimum 17.0 MPa.

.2 7 days: minimum 34.5 MPa.

.3 28 days: minimum 41.0 MPa.

.2 Slant Sheer Bond Strength, ASTM C 882:

.1 1 Day: minimum 5.0 MPa.

.2 7 Days: minimum 10.0 MPa.

.3 28 days: minimum 16.0 MPa.

.3 Drying Shrinkage, ASTM C157, Unmodified, 1-inch (25-mm) prisms:

.1 28 Days: less than 350 µstrain.

.4 Drying Shrinkage, ASTM C157, Modified, 3-inch (76-mm) prisms, air cured at 73 degrees F (23 degrees C), 50 percent relative humidity:

.1 7 Days: less than 225 µstrain.

.2 28 Days: lest than 500 µstrain.

.5 Coefficient of Thermal Expansion, ASTM C531:

.1 28 days: $10 \pm 0.1 \times 10^{-6}$ cm/cm per degree C.

.6 Freeze/Thaw Resistance, ASTM C666 at 300 cycles:

.1 minimum 96% relative dynamic modulus.

.7 Splitting Tensile Strength, ASTM C496:

.1 28 days: minimum 4.0 MPa.

.8 Rapid Chloride Permeability, ASTM C1202:

.1 Less than 1,000 Coulombs

.9 Acceptable products:

.1 MasterEmaco S 440 MC, formerly (LA Repair Mortar) by BASF Building Systems.

.2 Sikacrete-211 Flow Plus by Sika Canada.

.3 Sikacrete 08-SCC by Sika Canada.

.4 Substitutions will be considered in accordance with Bidding Procedures B7 - Substitutes.

2.2 EQUIPMENT

.1 Pumping equipment: Mono-type, piston/ball valve, or hydraulic/swing valve pumps capable of pumping specified grout. Pumping equipment must have adequate controls to regulate flow rates and pressures

2.3 ACCESSORIES

.1 Cure and sealing compound: to ASTM C309, Type 1.

.1 Acceptable products:

.1 Florseal WB by Sika Canada Inc. at a minimum application rate of 4.9 m²/L.

.2 MasterKure CC 160 WB, formerly(Kure-N-Seal WB) by BASF Building Systems at a minimum application rate of 4.9 m²/L.

.3 Substitutions will be considered in accordance with Bidding Procedures B7.

.2 Sealant: Dowsil 795.

.1 Substitutions will be considered in accordance with Bidding Procedures B7 - Substitutes.

Part 3 Execution

3.1 PREPARATION

.1 Protection: Protect adjacent Work areas and finish surfaces from damage during repair mortar application.

.2 Surface Preparation:

.1 Complete concrete delamination repairs to 03 91 10 – Surface Preparation for Concrete Delamination Repairs.

.3 The repair area must be thoroughly cleaned and well soaked prior to infilling. The surface should be thoroughly wetted for a period of not less than two (2) hours. The repair areas shall be kept continuously wet until just before infilling. Any standing water must be removed prior to grouting.

.4 Maintain the substrate in a saturated, surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.

.5 Forming:

.1 Unless otherwise indicated provide plywood formwork to match existing profiles.

.2 Install chamfers at outside corners and filets at inside corners in accordance with Section 03 10 00 or to match existing profiles.

.3 Design formwork to accommodate the mass and pressure of the repair material but not less than 14 psi (100 kPa).

.4 Securely anchor formwork to substrate. Anchors to be sized and space to prevent deflection of the forms during pressure grouting.

.5 Construct forms to fit tightly against existing concrete surfaces. Seal around edge of formwork with sealant to prevent leakage during grouting.

.6 Anchors shall be completely removable. All anchor holes shall be patched with same grout utilized for the repairs but mixed to dry pack consistency. Completely fill all anchor holes.

.7 A minimum of 30 mm concrete cover over the primary reinforcing steel will be required, thus, an adjustment of the formwork such as a notch may be required to ensure sufficient cover.

.8 Provide drainage outlets in formwork for presoaking and, if beneath a soffit, provide air venting. Provide suitable access points to pump mixed repair mortar into place.

.9 Space ports for pump line attached in a grid pattern.

.10 Use form-release agent to facilitate removal of forms from cast material.

.11 Within two (2) hours immediately prior to grouting, pressure test formwork to determine watertightness. Completely fill formwork with clean water and let stand for not less than 15 minutes. Any areas of leakage are to be sealed prior to grouting. Re-test as required.

3.2 INFILLING PROCEDURES

.1 Obtain the Contract Administrator’s approval before placing repair material. Provide minimum 24 hours notice.

.2 Maintain the substrate in a saturated, surface-dry (SSD) condition with no surface water, and concrete that is turning from dark to light.

.3 Mixing:

.1 Mix materials in accordance with manufacturer’s instructions.

.2 Ensure repair mortar is thoroughly mixed.

.3 Do not use free-fall mixers.

.4 Never mix partial bags.

.4 Within 15 minutes of mixing, pump the grout into the prepared form. Work in a manner to avoid air entrapment with a variable pressure pump.

.5 Start pumping at one corner for horizontal surfaces, or at the lowest point for vertical surfaces, continue filling in a manner that prevents air entrapment.

.6 Continue pumping until material flows from adjacent ports and all air is expelled. After all air is expelled, temporarily stop pumping, close off port, and begin pumping from next port that has seen material flow. Repeat sequence until the cavity is completely filled.

.7 Monitor pump-line pressure to prevent excessive back-pressure when pumping long distances.

.8 Vibrate the form while pumping, as required, to achieve flow and compaction. Flowable grout must be confined in either the horizontal or vertical direction, leaving a minimum of exposed surface.

3.3 CURING

.1 Concrete repairs to be cured for a minimum of 3 days at 10°C. Provide supplemental heat and hoarding as required throughout curing period.

.2 Leave formwork in place until repair mortar reaches compressive strength of 20 MPa.

.3 Upon removal of forms, apply two coats curing compound in accordance with manufacturer's specifications. Apply the first coat immediately upon removal of forms. Apply the second coat about 24 hours later.

3.4 FINISHING

.1 After stripping of formwork, any spaces not filled should be trimmed, cleaned, and dry-packed with grout to the desired profile. Do not proceed with repairs without the Contract Administrator's written approval.

3.5 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Contract Administrator in accordance with CSA-A23.1 and Section 01 45 00 - Quality Control and as described herein.

.2 The Contractor will pay for costs of tests as a unit price component.

.3 Not less than one test per 50 square feet of patching material placed and not less than one test for each day of placement.

.1 Test samples to be prepared by a CSA certified laboratory in accordance with ASTM C109.

.4 Direct pull-out tensile tests to determine bond strength will be completed throughout the course of the work but not less than the following:

.1 Three tests.

.2 The Contract Administrator reserves the right to take additional bond tests if concrete or bonding system is suspect.

.3 Infilling of the core hole will be the responsibility of the General Contractor. Unless otherwise directed by the Contract Administrator, repair in accordance with this Section.

.4 Test samples to be prepared by a CSA certified laboratory.

.5 Testing agency to submit copies of concrete test reports directly to The City and the Contract Administrator.

.6 Inspection or testing by the Contract Administrator will not augment or replace Contractor quality control nor relieve contractual responsibility.

3.6 DEFECTIVE CONCRETE

.1 Defective concrete: bond strengths below minimum specified value, cracking, spalling, scaling and concrete not conforming to required lines, details, dimensions, tolerances, finishes or specified requirements.

.2 Repair or replacement of defective concrete will be determined by the Contract Administrator, based on the specifications and the above guidelines.

.3 Do not patch, fill, touch up, repair or replace exposed concrete except upon express direction of the Contract Administrator for each individual use.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section covers the injection of a moisture insensitive epoxy adhesive to permanently repair non-moving cracks in load bearing concrete. The epoxy resin is to be injected into the cracks under pressure using automated metering equipment.

1.2 MEASUREMENT PROCEDURES

.1 Repair areas will be handled as a unit price repair.

.2 Repair areas will be identified and quantified via hammer soundings by the Contract Administrator in the presence of and with the assistance of the Contractor. The areas will then be measured and agreed upon by the Contractor and the Contract Administrator prior to commencement of work.

.3 Unit prices are to include:

.1 Supervision, labour and materials, and equipment.

.4 If the area of the repair is increased over that originally measured without consultation with the Contract Administrator, then the Contractor will not be paid for the increased area.

.5 Unit Prices:

.1 Epoxy injection crack repair:

.1 Unit of measure: per lineal foot (L.F.).

.2 The minimum area of payment will be one (1) L.F.

1.3 REFERENCES

.1 ASTM C881-02 Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

1.4 QUALITY ASSURANCE

.1 The Contractor or his sub-contractor must be a trained, approved applicator who is qualified to do epoxy injection for the purpose of structural concrete bonding.

.2 The applicator shall provide a minimum of three (3) local references exhibiting successful performance in grouting repairs with the specified product.

Part 2 Products

2.1 MATERIALS

.1 Epoxy: Moisture-insensitive, low-viscosity, high-strength, multipurpose, epoxy resin adhesive.

.1 Acceptable products:

.1 Sika: Sikadur 35 HI-Mod LV manufactured by Sika Canada Inc.

.2 Concressive Standard LVI by MBT/Chemrex Inc.

.3 Substitutions will be considered in accordance with Bidding Procedures B7 - Substitutes.

.2 Epoxy gels for the surface sealing shall conform to ASTM C881, Type IV, Grade 3, Class B or C and of the same manufacturer as the injection resin.

2.2 EQUIPMENT

.1 The equipment used to metre and mix the two injection adhesive components and inject the mixed adhesive into the crack shall be portable, and capable of accurately proportioning and mixing the epoxy resin as well as maintaining constant pressure, ratio control and steady flow under all relevant pressure conditions.

.2 The pumps shall be electric or air powered and shall provide in-line metering and mixing.

.3 The injection equipment shall have automatic pressure control capable of discharging the mixed adhesive at any pre-set pressure up to 160 ± 5 psi and shall be equipped with a manual pressure control override.

.4 The equipment shall have the capability of maintaining the volume ratio for the injection adhesive prescribed by the manufacturer of the adhesive within a tolerance of ±5% by volume at any discharge pressure up to 160 psi.

.5 The injection equipment shall be equipped with sensors on both the component A and B reservoirs that will automatically stop the machine when only one component is being pumped to the mixing head.

Part 3 Execution

3.1 PREPARATION

.1 Remove dirt, dust, laitance, efflorescence, deteriorated concrete and other materials which will prohibit adequate surface seal adhesion from the surface by mechanical means. Acids and corrosives shall not be permitted for cleaning.

.2 Remove loose dust, obstructions, and other materials which will prohibit adequate performance from the areas to be injected by vacuum, oil-free compressed air or other approved means.

3.2 PROCEDURE

.1 Entry ports shall be provided along the crack at intervals of not less than the thickness of the concrete at that location.

.2 Surface seal material shall be applied to the face of the crack between the entry ports. For through cracks, surface seal shall be applied to both faces as necessary to prevent leakage of the injection resin.

.3 Allow enough time for the surface seal material to gain adequate strength before proceeding with the injection.

.4 For vertical and inclined orientations, start injection process on port of lowest elevation. When injection resin shows at port above, cap lower entry port and continue injection process on the second port. Continue process until all ports have been injected and pressure is maintained.

.5 For horizontal orientations, inject from one end of the crack to the other using same port-to-port procedures. When possible, inject from bottom side of structure.

.6 Perform epoxy adhesive injection continuously until cracks are completely filled.

.7 If port to port travel of epoxy adhesive is not indicated, the work shall immediately be stopped and the Contract Administrator notified.

.8 When cracks are completely filled, epoxy adhesive shall be cured for sufficient time to allow removal of surface seal without any draining or runback of epoxy material from cracks.

3.3 CLEANING

.1 Finish the face of the crack approximately flush to the adjacent concrete showing no indentations or protrusions caused by the placement of entry ports. Ports must be removed flush.

.2 Cured resin on the concrete surface used to seal the crack and secure the ports shall be completely ground away to remove the resin from the surface of the concrete.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-A165 Series-94(R2000), Standards on Concrete Masonry Units.

.2 CSA A179-94(R1999), Mortar and Grout for Unit Masonry.

.3 CSA-A371-94 (R1999), Masonry Construction for Buildings.

1.2 QUALIFICATION ASSURANCE

.1 Applicator: Company specializing in commercial masonry Work with five years experience and approved by the Materials manufacturer.

.2 Installation of Masonry Work: CAN3-A371M, except where specified otherwise.

1.3 MASONRY INFILL SCOPE OF WORK

.1 Refer to Drawings for the scope of Work required for infill and repair and repointing of existing concrete masonry unit (CMU) masonry.

Part 2 Products

2.1 NEW CONCRETE MASONRY UNITS (CMU)

.1 Thickness 200mm (8”), 140mm (6”) and 90mm (4”) non-load bearing units, type H/15/A/M, as noted on Drawings.

.2 Colour: grey.

.3 Provide square units with bull-nose corners for all exposed 90 degree corners, including fin walls and door openings.

.4 Provide purpose made shapes for lintels and bond beams.

2.2 MORTAR MATERIALS

.1 All mortar for masonry shall be Type “S” mortar having a minimum strength of 13mPa @ 28 days. Mortar to be in accordance with the latest edition of CSA A179.

Part 3 Execution

3.1 CONSTRUCTION

.1 Cutting.

.1 Refer to Structural Drawings for sequence of masonry removals, steel installations, masonry reconstruction, and grout filling required for new openings.

.2 Cut out for electrical device boxes, and other recessed or built-in objects.

.3 Make cuts straight, clean, and free from uneven edges.

.4 Ease exposed edges to match existing.

.2 Building-In.

.1 Build in items required to be built into masonry.

.2 Prevent displacement of built-in items during construction.

.3 Fill spaces between door jambs and masonry with mortar.

.3 Interface with other Work.

.1 Cut openings in existing Work as indicated.

.2 Openings in walls for duct and piping penetrations:

.1 All piping penetrations through exposed masonry walls are to be cored to suit pipe diameter, and sealed all around.

.2 Re-use existing piping penetrations where possible – new penetrations are to be cored, and penetrations sealed all around.

.3 Make good existing Work. Use Materials to match existing.

3.2 ERECTION & COURSING

.1 Verify lines, levels and dimensions prior to laying masonry. Notify Consultant of discrepancies.

.2 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

.3 Lay interior concrete masonry units as follows:

.1 Bond: running stretcher

.2 Coursing height: 200mm (8") for one (1) block and one (1) joint

.3 Plain block jointing: concave where exposed or where paint or other finish coating is specified

3.3 SITE TOLERANCES

.1 Tolerances in notes to Clause 5.3 of CSA-A371 apply.

3.4 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation, remove surplus Materials, rubbish, tools and equipment barriers.

3.5 PROTECTION

.1 Protect masonry and other Work from marking and other damage. Protect completed Work from mortar droppings. Use non-staining coverings.

END OF SECTION

Part 1 General

1.1 MEASURMENT PROCEDURES

.1 No measurement will be completed for carpentry work identified on Drawings as part of the lump sum tender component. Costs for this work to be included in the lump sum tender amount.

1.2 REFERENCES

.1 American society of Mechanical Engineers (ASME)

.1 ASME B18.6.1-1981, Wood Screws (Inch Series).

.2 Canadian Standards Association (CSA International)

.1 CSA O80 Series-15, Wood Preservation
.2 CSA O141-05(2014), Softwood Lumber.
.3 CSA O325-16, Construction Sheathing.

.3 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2017.

1.3 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood in accordance with CSA standard.

Part 2 Products

2.1 FRAMING AND STRUCTURAL MATERIALS

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:

.1 CSA O141.
.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Furring, blocking, and nailing strips, all to be pressure treated.

.3 Structural Composite Lumber (SCL) in accordance with ASTM D5456.

2.2 PANEL MATERIALS

.1 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.0.

2.3 ACCESSORIES

.1 Screws: to ASME B18.6.1.

2.4 FASTENER FINISHES

.1 As shown on Drawings:

.1 300 series stainless steel.

.2 400 series stainless steel.

.3 Corrosion resistant finish:

.1 Multi-layered application.

.2 To ASTM B117.

2.5 WOOD PRESERVATIVE

.1 Wood Preservative:

.1 CCA or other water-born salt, free of petroleum solvents and oils, applied by pressure treatment in accordance with CSA O80.

.2 Factory application:

.1 Supply by a CSA certified treating plant.

.2 Apply CSA stamp certifying that product meets the requirements of CSA O80.

Part 3 Execution

3.1 PREPARATION

.1 Store wood products.

3.2 INSTALLATION

.1 Install members true to line, levels and elevations, square and plumb.

.2 Construct continuous members from pieces of longest practical length.

.3 Install spanning members with "crown-edge" up.

.4 Install furring and blocking as required to space-out and support bucks and finish trim, and other work as required.

.5 Install rough bucks, nailers and linings to rough openings as shown on Drawings to provide backing for frames and other work.

.6 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

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 WOOD PRESERVATION

.1 Use pressure-treated wood at locations shown on Drawings.

.2 Wood treatment:

.1 Field:

.1 Treat in field:

.1 Damage to surface of factory applied treated material:

.1 Cuts.

.2 Abrasions.

.3 Nail and spike holes.

.2 Site sawn treated lumber and panel ends and edges.

.3 Preservative in accordance with CSA O80.

.4 Brush apply 2 coats of preservative treatment to thoroughly saturate in accordance with CSA O80.

.2 Apply preservative treatment in accordance with:

.1 CSA O80.

.2 Manufacturer's directions.

.3 Allow preservative to cure prior to placing members.

.3 Handling and use of treated material:

.1 Handle and use treated material in a manner that will avoid damage or field fabrication causing alteration in original treatment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Supply and installation of vapour retarders to crawlspace floor as shown on Drawings.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D1709 - 16ae1, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method

.2 ASTM D4833 / D4833M - 07(2020), Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products

.3 ASTM E96 / E96M – 16, Standard Test Methods for Water Vapor Transmission of Materials

.4 ASTM E154 / E154M - 08a(2019), Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

.5 ASTM E1643 - 18a, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

.6 ASTM E1745 – 17, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

.7 ASTM F1249 – 20, Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

1.3 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:

.1 Product characteristics.

.2 Performance criteria.

.3 Limitations.

.3 Quality assurance submittals:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions and comply with written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

1.4 QUALITY ASSURANCE

.1 Qualifications

.1 Installers are to be specialized in the installation of vapour retarders with a minimum of three years each of documented experience.

.2 Perform Work in accordance with manufacturer’s written instructions.

.3 Maintain one copy of manufacturer’s written instructions on site.

.4 Single-Source Responsibility:

.1 Obtain vapour retarder materials from a single manufacturer regularly engaged in manufacturing the product.

.5 Mock-Ups:

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

.2 Construct mock-up of vapour retarder installation including one lap joint, one inside corner and at exterior perimeter wall interface. Mock-up may be part of finished work.

.3 Mock-up will be used to judge workmanship, substrate preparation, and material application.

.4 Locate where directed.

.5 Allow 72 hours for inspection of mock-up by the Contract Administrator before proceeding with vapour retarder work.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

Part 2 Products

2.1 SHEET VAPOUR BARRIER

.1 Sheet Vapour Retarder:

.1 Vapour retarder membrane in accordance with ASTM E1745.

.2 Performance Requirements:

.1 Water Vapour Permeance:

.1 Maximum in accordance with ASTM E154 Sections 7, 8, 11, 12, 13, by ASTM E96, Method B or ASTM F1249:

.1 As Received: <0.01 perms.

.2 After wetting and drying: <0.01 perms.

.3 Resistance to plastic flow and temperature: <0.01 perms.

.4 Effect low temperature and flexibility: <0.01 perms.

.5 Resistance to deterioration from organisms and substances in contacting soil: <0.01 perms.

.2 Puncture resistance:

.1 > 3 200 grams in accordance with ASTM D1709.

.2 200 N in accordance with ASTM D4833.

.3 Tensile strength: 72 lb. Force/inch in accordance with ASTM E154, Section 9.

.3 Thickness: 15 mils minimum.

.4 Acceptable Products:

.1 StegoCrawl Wrap.

.2 Perminator by W.R. Meadows.

.3 Substitutions will be considered in accordance with Bidding Procedures B7 – Substitutes.

2.2 ACCESSORIES

.1 Joint sealing tape:

.1 Air resistant pressure sensitive adhesive tape recommended by sheet vapour barrier manufacturer.

.2 Mastic:

.1 Compatible with vapour retarder materials, recommended by sheet vapour retarder manufacturer.

.3 Sealant:

.1 Compatible with vapour retarder materials, recommended by sheet vapour retarder manufacturer.

.4 Zip Tie:

.1 Heavy duty UV stabilized nylon.

.2 Self locking head.

.3 Breaking strength: 250 lb.

Part 3 Execution

3.1 PREPARATION

.1 Confirm substrate is final graded and suitable for installation of sheet vapour retarder.

.2 Ensure services are installed and inspected prior to installation of retarder.

3.2 INSTALLATION

.1 Use sheets of largest practical size to minimize joints.

.2 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

.3 Install liner in accordance with manufacturer's instructions and ASTM E1643.

3.3 EXTERIOR SURFACE OPENINGS

.1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

3.4 PERIMETER SEALS

.1 Seal perimeter of sheet vapour barrier in accordance with manufacturer directions and as shown on Drawings.

3.5 LAP JOINT SEALS

.1 Unless manufacturer directions specify otherwise, seal lap joints of sheet vapour barrier as follows:

.1 Attach first sheet to substrate.

.2 Apply continuous bead of sealant over solid backing at joint.

.3 Lap adjoining sheet minimum 12" and press into sealant bead.

.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.6 PIPE AND PILE INSTALLATION

.1 Seal sheet vapour retarder around pipe and pile penetrations by installing collar in accordance with manufacturer directions.

.2 Seal sheet vapour retarder intersection with pipe and pile with mastic, joint sealing tape and zip ties.

3.7 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 RELATED SECTIONS

.1 Section 01 21 00 Allowances
.2 Section 01 33 00 Submittal Procedures
.3 Section 01 61 00 Common Product Requirements
.4 Section 03 30 00 Cast in place Concrete
.6 Section 04 05 10 – Common Masonry
.7 Division 22 & 23 - Mechanical
.8 Section 26 00 10 – Basic Electrical Materials and Methods

1.2 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

1. Provide fire and smoke stop systems consisting of a material, or combination of materials installed to maintain the integrity of the Fire Resistance Rating of the fire separation by maintaining an effective barrier against the spread of flame, smoke, heat and / or hot gases through penetrations, blank openings, construction joints, or at perimeter fire containment in or adjacent to the Fire Separation in accordance with the requirements of the National Building Code.

.2 All fire separations to have a Fire Resistance Rating to them as indicated on drawings. All Non-rated Fire Separations to be assigned a 45-minute Fire Resistance Rating or an F-Rating of ¾ hour minimum. Both sides of a non-rated fire separation to have a tested fire and smoke stop system applied, to match or exceed the F-rating, as indicated.

.3 All multiple service penetration through a fire separation must have a minimum space equal to the same size of the smallest pipe or greater, minimum 50mm, between pipes to be considered an individual services penetration. Penetrations where the space between penetrating items is less than 50mm will be classified as a multi-penetrations and a square or rectangular opening shall be constructed around the penetrations with a fire and smoke stop system applied to the entire opening.

1.3 REFERENCES

.1 Standard Method of Fire Tests Through Penetration Fire Stops, ULC-S115-M.2005/ CAN4-S115-M.2005 or ASTM E814 Test Requirements or latest.
.2 Underwriters Laboratories (UL) ASTM E-814 under their designation of UL 1479, Fire-Tests of Through Penetration Firestops and publishes the results in FIRE RESISTANCE DIRECTORY. UL tests that meet the requirements of ULC-S115-M.2005 are given a cUL listing and are published by UL in Products Certified for Canada (cUL) Directory.
.3 Latest edition of the ULC or cUL Listings for Firestop Systems and Components.
.4 Standard Test Method for Surface Burning Characteristics of Building Materials, CAN/ULC-S102-M or ASTM E84 or latest.
.5 Method for Fire tests of Building Construction and Materials CAN/ULC-S101 or ASTM E119 or latest.
.6 International Firestop Council Guidelines (IFC) for Evaluating Firestop Systems Engineering Judgements.
.7 International Firestop Council (IFC) Inspection Guideline and ASTM E2174-04, Standard Practice for On-Site Inspection of Installed Firestop Systems and ASTM E2393-04, or latest Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
.8 National Building Code and the Provincial Building Code of the Province that the Authority Having Jurisdiction is responsible for.
.9 NFPA 101-Life Safety Code
.10 Canadian Electrical Code

1.4 DESIGN SYSTEM LISTINGS/SHOP DRAWINGS

.1 Submit Design System Listings, product data and Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00. Also provide the following product data on each proposed

product:
- .1 Technical data on out-gassing; off-gassing and age testing.
- .2 Curing time.
- .3 Chemical compatibility to other construction materials.

.2 Provide Certification by the Manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's).
- .1 According to ASTM E595.
- .2 Test Method: Environmental Protection Association, EPA Method 24.
- .3 Indoor Environmental Quality: Volatile Content: below 250 g/l.
- .4 **DO NOT** use silicone firestops.

.3 Design System Listings shall show proposed material, including technical data, reinforcement, anchorage, fastenings and method of installation. Construction details shall accurately reflect actual job conditions.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials undamaged in manufacturer's clearly labelled, unopened containers, identified with brand, type, and ULC or cUL label, complete with batch number, manufacturing date and shelf life expiry date.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Do not install firestopping when ambient or substrate temperatures are outside limits permitted by Manufacturers or when substrates are wet, due to rain, frost, condensation, or other causes.

1.7 WARRANTY

.1 Manufacturers shall warrant work of this Section against defects and deficiencies in the product material for a period of two (2) years from date of Substantial Performance, in accordance with General Conditions of Contract. Promptly correct any defects or deficiencies, which become apparent within warranty period at no expense to the City.

.2 Fire and smoke stop system Contractor hereby warrants workmanship on material installation for period of two (2) years from date of Substantial Performance, in accordance with General Conditions of Contract. Promptly correct any defects or deficiencies, which become apparent within warranty period at no expense to the City.

Part 2 Products

2.1 MATERIALS

.1 Fire-stopping and smoke-seal systems: in accordance with CAN4-S115-M2005 or latest or ASTM E814 or latest.
- .1 Asbestos-free materials and systems capable of maintaining an effective barrier against the passage of flame, smoke, water and toxic gases in compliance with requirements of CAN4-S115-M2005 or latest or ASTM E814 or latest, and not to exceed opening sizes for which they are intended, in accordance with ULC or cUL Design Numbers or other Design System Listings acceptable to local Authority Having Jurisdiction.
- .2 Firestopping materials/systems shall be flexible to allow for movement of building structure (refer to architectural and structural) and penetrating item(s) without affecting the adhesion or integrity of the system.

.2 Fire-stop Methods:
- .1 Method 1: non-combustible, semi-rigid, felt; minimum density 65 kg per cu/m^2; depth 100 mm, length 1200 mm; width as required. Blanket type fire-stop to be listed, and labelled in accordance with file Guide 40-U19.13. Impale - clips; galvanized wire or 25 mm x 0.65 mm thick galvanized steel Z-clips with dimensions to match location of fire stop material and width of opening being sealed.
- .2 Method 2: as per Method 1, without impale - clips.

.3 Method 3: Hose stream UL/cUL (Underwriters Laboratories USA) labelled.
.4 Method 4: Hose stream, fluid, gas and fire-resistant elastomeric seal or non-shrink foam cement mortar proprietary certified assembly of a listed manufacturer.
.5 Methods 1 to 4: Methods used can be as per manufacturer's instructions, provided that their system employed meets or exceed the requirements of ULC/CAN4-S115-M2005 or ASTM E814 or latest.

.3 Mechanical or Electrical service: penetration assemblies; certified in accordance with CAN4-S115-M2005 or latest or ASTM E814 or latest and listed in the ULC Guide No. 40 U19.
.4 Service - penetration fire-stop components: Certified in accordance with CAN4-S115-M95 or latest or ASTM E814 or latest and listed in the ULC Guide No. 40 U19.
.5 Fire-resistance rating of installed fire-stopping assembly not less than fire-resistance rating of surrounding substrate assembly (floor or wall) in accordance with the NBC.
.6 Fire-stopping and smoke-seals at openings intended for re-entry such as cables; elastomeric seal or non-shrink foam cement mortar: do not use cementitious or rigid seal at such locations.
.7 Firestopping and smoke-seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal; do not use a cementitious or rigid seal at such locations.
.8 Primers: to manufacturer's recommendation for specific material, substrate, and end-use.
.9 Water (if applicable: portable, clean and free from injurious amounts of deleterious substrates.)
.10 Damming and back-up materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
.11 Sealants for vertical joints: non-sagging and having a flame-spread of not more than 25 and a maximum smoke development classification of 100 for walls and 50 for ceilings.

2.2 PRODUCT SYSTEMS

.1 Single source responsibility: obtain firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.
.1 Materials of different manufacturers shall not be intermixed on the project.
.2 Acceptable manufacturers:
.1 AD Fire Protection Systems Inc
.2 Hilti Fire Stop
.3 3M Fire Protection
.4 Tremco, Tremstop, Firestop Systems
.5 Rectorseal, Biofireshield

2.3 ACCEPTABLE FIRE STOP APPLICATORS

.1 National Firestop Ltd.
.2 Total Fire Stop Systems Limited
.3 Western Construction Services Ltd.
.4 Groundstar Systems (1987) Ltd.
.5 Secure Firestop

Part 3 Execution

3.1 EXAMINATION

.1 Verify substrate conditions, previously installed are acceptable for product installation in accordance with manufacturer’s instructions and approved design system listings for each condition.
.2 Ensure that opening / annular space does not exceed the maximum and minimum size or dimensions that is indicated on the approved Design Listing.
.3 Verify that all joints, service penetrating elements and supporting

devices/hangers have been properly installed as indicated on Approved Design Listings. All temporary lines and markings have been removed to meet the approved Design System Listings for each condition has been identified.

3.2 INSTALLATION

.1 Protect adjacent work areas and finish surfaces from damage during product installation.

.2 Install firestopping and smoke-seal material and components in accordance with manufacturer's instructions and rated system as tested to ULC/CAN4-S115-M2005, and ULC or cUL Design System Listings.

.3 Coordinate with other Sub-Trades to assure that all pipes, conduit, cable, and other items, which penetrate fire separations have been permanently installed prior to installation of firestop systems.

.4 Schedule the work to assure that fire separations and all other construction that conceals penetrations are not erected prior to the installation of fire and smoke stop systems.

.5 Seal holes or voids made by through-penetrations, poke-through termination devices, and un-penetrated openings or joints to ensure that both continuity and integrity of fire-separation are maintained.

.6 Provide temporary forming as required. Remove forming material only after firestop system has gained sufficient strength and after initial curing as per manufacturer's instructions.

.7 Tool or trowel exposed surface to a neat finish and to accepted architectural finishes as approved by the Contract Administrator.

.8 Remove excess compound promptly as work progresses and upon completion.

.9 Refer to Mechanical and Electrical Sections and drawings for further information.

3.3 SCHEDULE OF FIRESTOP LOCATIONS

.1 Fire stop and smoke-seal includes but not limited, to the following locations:

.1 Provide appropriate Firestop System when exposed to view, architectural finish as indicated in Finish Schedule, traffic, moisture, heat, movement and physical damage.

.2 Penetrations through fire-resistance-rated masonry, concrete, and gypsum board partitions/walls, floors and roof assemblies.

.3 Intersection of fire-resistance-rated masonry, concrete and gypsum board partitions.

.4 Joints at top and bottom of fire resistance rated concrete masonry and gypsum board partitions. Joints to allow for independent movement.

.5 Control and sway joints in fire-resistance-rated masonry and gypsum board partitions and walls.

.6 Penetrations through fire-resistance-rated floor slabs/systems, ceilings and roof.

.7 Openings and sleeves installed for future use through fire separations and unused openings and sleeves constructed as part of work.

.8 Around mechanical and electrical assemblies/devices penetrating fire separations.

.9 Between edge of fire-resistant floor or roof assemblies and exterior wall assemblies.

.10 Between floors, walls, ceilings and roof assemblies at horizontal and vertical fire-resistant ratings at floor expansion joints.

.11 Rigid ducts: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

.12 Mechanical and electrical recessed boxes in walls and partitions.

.13 Where indicated on working drawings and specification detail drawings.

3.4 THIRD PARTY CONSULTANT REVIEW

.1 Contract Administrator shall be called to perform random observation reviews during the course of construction and prior to closing off any concealed areas. These observations shall be based on ASTM E2174 Standard Practice for on-site inspection of

Installed Firestop Systems and ASTM E2393 Standard practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers. Contractor shall notify Contract Administrator minimum of 48-hours prior to requesting review.

.2 The Contract Administrator shall perform exploratory review (destructive test) based on ASTM E2174, and E2393 where the system will be cut out by the Firestopping Subcontractor as directed by the Contract Administrator and removed to ensure the firestop system installed meets or exceeds the Design System Listing as identified.

.3 The Firestopping Subconsultant e shall do all cutting and removal of the systems for visual review from the Contract Administrator. Once the review is completed and accepted, the Firestopping Subcontractor shall replace the firestop system with new. All costs for cutting, removing and replacement shall be included in base bid.

3.5 CLEAN-UP

.1 Remove equipment, excess materials and debris and clean adjacent surfaces immediately after application. Use methods and cleaning materials approved by Manufacturer.

.2 Protect firestopping during and after curing period from contact with contaminating substances. If damage caused by others, the Contractor shall instruct the Firestop Subcontrctor to make appropriate repairs and charge to appropriate trades.

.3 Remove temporary dams after initial set of fire stop and smoke seal materials.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures
.2 Section 01 61 00 – Common Product Requirements
.3 Section 06 10 00 – Rough Carpentry
.4 Section 07 92 00 – Joint Sealing
.5 Section 08 71 00 – Door Hardware – General
.6 Section 09 90 00 – Painting

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM).
  .1 ASTM A 653M-95, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process or latest.
  .2 ASTM B 29-[92], Specification for Pig Lead or latest.
  .3 ASTM B 749-85(1991), Specification for Lead and Lead Alloy Strip, Sheet and Plate Products or latest.
.2 Canadian General Standards Board (CGSB).
  .1 CAN/CGSB-1.181-92, Ready-Mixed Organic Zinc-Rich Coating or latest.
  .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors or latest.
  .3 CAN/CGSB-51.20-M87, Thermal Insulation, Polystyrene, Boards and Pipe Covering or latest.
  .4 CGSB 51-GP-21M-78, Thermal Insulation, Urethane and Isocyanurate, Unfaced or latest.
.3 Canadian Standards Association (CSA).
  .1 CSA A101-M1983, Thermal Insulation, Mineral Fibre, for Buildings or latest.
  .2 CAN/CSA-G40.21-M92, Structural Quality Steels or latest.
  .3 CSA W59-M1989, Welded Steel Construction (Metal Arc Welding) or latest.
.4 Canadian Steel Door and Frame Manufacturers' Association, (CSDFMA).
  .1 CSDFMA, Specifications for Commercial Steel Doors and Frames, 1990 or latest.
  .2 CSDFMA, Recommended Selection and Usage Guide for Commercial Steel Doors, 1990 or latest.
.5 National Fire Protection Association (NFPA).
  .1 NFPA 80-1992, Fire Doors and Windows or latest.
  .2 NFPA 252-1990, Door Assemblies, Fire Tests of or latest.
.6 Underwriters' Laboratories of Canada (ULC).
  .1 CAN4-S104M- M80(R1985), Fire Tests of Door Assemblies or latest.
  .2 CAN4-S105M-M85, Fire Door Frames or latest.

1.3 DESIGN REQUIREMENTS

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35ºC to 35ºC.
.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

1.4 SHOP DRAWINGS

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

.2 Indicate each type of door, Material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazing, louvers, arrangement of hardware and fire rating and finishes.

.3 Indicate each type frame Material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing, fire rating, finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on Drawings and door and interior glazing schedule.

.5 Submit test and engineering data, and installation instructions.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

.1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104M or latest for ratings specified or indicated.

.2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled. Test products in strict conformance with CAN4-S104 or latest, ASTM E 152 or latest or NFPA 252 or latest and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

1.6 SCHEDULE

.1 Doors and frames listed on door schedule and interior glazing schedule are furnished as an assistance to the fabricator, and should not be considered as entirely inclusive. Examine Drawings and Specifications, and determine extent and quantity required. Should any door or frame be omitted in the schedule, the fabricator shall supply door or frame as required for similar or same purpose.

Part 2 Products

2.1 MATERIALS - STEEL

.1 Hot dipped galvanized steel sheet: to ASTM A 653M or latest, minimum base steel thickness in accordance with CSDFMA Table 1 - Thickness for Component Parts or latest.

.2 Reinforcement channel: to CAN/CSA-G40.21 or latest, Type 44W, coating designation to ASTM A 653M or latest.

.3 Cast or rolled pure sheet lead: to ASTM B 29 or latest, weight: 14.6 kg/m2, thickness 3/64”.

.4 Composites: balance of core Materials used in conjunction with lead: in accordance with manufacturers' proprietary design.

2.2 DOOR CORE MATERIALS

.1 Honeycomb construction:

.1 Structural small cell, 1” maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m3 minimum sanded to required thickness.

.2 Stiffened: face sheets welded, insulated core.

.1 Fibreglass: to CSA A101 or latest, semi-rigid RSI 2.3.

.2 Polyurethane: to CGSB 51-GP-21M or latest rigid, modified poly/isocyanurate, closed cell board. Density 32 kg/m3.

.3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250ºC at 60 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104 or latest, ASTM E 152 or latest or NFPA 252 or latest, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

.4 Thermal insulation Material must:

.1 not require being labelled as poisonous, corrosive, flammable or explosive under the Consumer Chemical and Container Regulations of the Hazardous Products Act;

.2 be manufactured using a process that uses chemical compounds with the minimum ozone depletion potential (ODP) available.

2.3 ADHESIVES

.1 Select Adhesives which:

.1 do not contain volatile organic compounds in excess of 5 % by weight as measured by EPA Method 24-24A, 40 C.F.R., Part 60, Appendix A (1991), as demonstrated through calculation from records of the amounts of constituents used to make the product;

.2 are accompanied by detailed instructions for proper application so as to minimize health concerns and maximize performance;

.3 are accompanied by information describing proper disposal methods for containers.

.2 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.3 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

.4 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMERS

.1 Touch-up prime CAN/CGSB-1.181 or latest.

2.5 PAINT

.1 Steel doors and frames shall be field painted in accordance with Section 09 90 00. Weatherstrips shall be protected from paint. Finish shall be free of scratches or other blemishes.

.2 Paint: water based, manufactured without compounds which contribute to ozone depletion in the upper atmosphere, does not contain toxic metal pigments.

2.6 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior top and bottom caps: steel.

.3 Interior top and bottom caps: steel.

.4 Metallic paste filler: to manufacturer's standard.

.5 Fire labels: metal riveted.

2.7 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDFMA Specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Exterior frames: 16 gauge minimum thermally broken type construction.

.4 Interior frames: 16 gauge minimum welded type construction.

.5 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.6 Protect mortised cutouts with steel guard boxes.

.7 Prepare frame for door silencers, 3 for single door, 2 at head for double door.

.8 Manufacturer's nameplates on frames and screens are not permitted.

.9 Conceal fastenings except where exposed fastenings are indicated.

.10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.11 Insulate exterior frame components with polyurethane insulation.

2.8 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebate opening heights up to 5’-0” and 1 additional anchor for each additional 2’-6” of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 6” from top and bottom of each jambs and intermediate at 2’-2” o.c. maximum.

.5 Frames for installation in stud partitions shall be provided with steel anchors of suitable design. For installation inside each jamb as follows:

.1 Frames up to 7’-8” height – four (4) anchors

.2 Frames 7’-8” to 8’-2” – five (5) anchors

2.9 LABELED FIRE DOORS AND FRAMES

.1 Provide labeled fire doors and frames for openings requiring fire protection ratings as scheduled, and generally in the following locations: firewalls and fire separations, corridors, stairwells, and to storage and mechanical rooms. Attach ULC labels to doors and frames.

.2 Doors with bottom vertical rods must be sized to provide proper bottom clearance.

2.10 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59 or latest.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

.7 Securely attach lead to inside of frame profile from return to jamb soffit (inclusive) on door side of frame only.

2.11 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.

.2 Exterior doors: 16 gauge, Insulated Core construction.

.3 Interior doors: 16 gauge, honeycomb construction.

.4 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.5 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware in accordance with ASTM E 330 or latest.

.6 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.7 Factory prepare holes ½" diameter and larger except mounting and through-bolt holes, on Site, at time of hardware installation.

.8 Reinforce doors where required, for surface mounted hardware. Provide flush PVC top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.9 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.10 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in strict conformance with CAN4-S104 or latest, ASTM E 152 or latest or NFPA 252 or latest and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.11 Manufacturer's nameplates on doors are not permitted.

2.12 DOORS: HONEYCOMB CORE CONSTRUCTION

.1 Form each face sheet for exterior doors from 16 gauge sheet steel with polyurethane core laminated under pressure to face sheets.

.2 Form each face sheet for interior doors from 16 gauge sheet steel with temperature rise rated core laminated under pressure to face sheets.

2.13 HOLLOW STEEL CONSTRUCTION

.1 Form each face sheet for exterior doors from 16 gauge minimum sheet steel.

.2 Form each face sheet for interior doors from 16 gauge minimum sheet steel.

.3 Reinforce doors with vertical stiffeners, securely welded to each face sheet at 6" on centre maximum.

.4 Fill voids between stiffeners of exterior doors with polyurethane core.

.5 Fill voids between stiffeners of interior doors with temperature rise rated core.

2.14 THERMALLY BROKEN DOORS AND FRAMES

.1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.

.2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma or latest.

.3 Apply insulation.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDFMA Installation Guide.

3.2 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 4'-0" wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent Material.

.6 Maintain continuity of air/vapour barrier membrane.

3.3 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Door Schedule.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.

.1 Hinge side: 3/64".

.2 Latchside and head: 3/64".

.3 Finished floor, top of carpet, noncombustible sill, and thresholds: ½".

.3 Adjust operable parts for correct function.

.4 Install louvers as indicated.

3.4 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 45 00 – Quality Control

.3 Section 01 61 00 – Common Product Requirements

.4 Section 01 78 00 – Closeout Submittals

.5 Section 06 10 00 – Rough Carpentry

.6 Section 08 11 00 – Steel Doors and Frames

1.2 REFERENCES

.1 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).

.1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.

.2 Canadian General Standards Board (CGSB).

.2 CAN/CGSB-69.17-M86(R1993), Bored and Preassembled Locks and Latches or latest.

.3 CAN/CGSB-69.18-M90ANSI/BHMA A156.1-1981, Butts and Hinges or latest.

.4 CAN/CGSB-69.20-M90/ANSI/BHMA A156.4-1986 Door Controls (Closers) or latest.

.5 CAN/CGSB-69.21-M90/ANSI/BHMA A156.5-1984, Auxiliary Locks and Associated Products or latest.

.6 CAN/CGSB-69.22-M90/ANSI/BHMA A156.6-1986, Architectural Door Trim or latest.

.7 CAN/CGSB-69.24-M90/ANSI/BHMA A156.8-1982, Door Controls - Overhead Holders or latest.

.8 CAN/CGSB-69.29-93/ANSI/BHMA A156.13-1987, Mortise Locks and Latches or latest.

.9 CAN/CGSB-69.31-M89/ANSI/BHMA A156.15-1981, Closer/Holder Release Device or latest.

.10 CAN/CGSB-69.32-M90/ANSI/BHMA A156.16-1981, Auxiliary Hardware or latest.

.11 CAN/CGSB-69.33-M90/ANSI/BHMA A156.17-1987, Self-closing Hinges and Pivots or latest.

.12 CAN/CGSB-69.34-93/ANSI/BHMA A156.18-1987, Materials and Finishes or latest.

.13 CAN/CGSB-69.36-M90]ANSI/BHMA A156.20-1984, Strap and Tee Hinges and Hasps or latest.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, Specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Samples:

.1 Submit one of each unique piece of hardware for review by Contract Administrator. For hinges, one hinge is acceptable in lieu of a full set. For kickplates and other items with varying dimensions, one 50mm x 50mm sample

showing finish and fasteners is acceptable in lieu of full size. Send in accordance with Section 01 33 00 - Submittal Procedures.

.3 Hardware List:

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

.2 Indicate specified hardware, including make, model, Material, function, size, finish and other pertinent information.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.5 Closeout Submittals

.1 Provide operation and maintenance data for door closers, locksets, door holders electrified hardware and fire exit hardware for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.3 Certificates: product certificates signed by manufacturer certifying Materials comply with specified performance characteristics and criteria and physical requirements.

.4 Pre-installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

.5 Warranties: Provide a 1 year warranty as provided in General Conditions for Construction for all hardware and associated component supplied under this Section, except for the Automatic door operators and their related components shall have a 2 year warranty (including the motor and the operating unit).

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.2 Deliver, store, handle and protect Materials in accordance with Section 01 60 00 - Basic Product Requirements.

.3 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.4 Storage and Protection:

.1 Store finishing hardware in locked, clean and dry area.

1.6 WASTE DISPOSAL AND MANAGEMENT

.1 Remove from Site and dispose of packaging Materials at appropriate recycling facilities.

.2 Dispose of corrugated cardboard, polystyrene, plastic packaging Material in appropriate on-site bin for recycling in accordance with Site waste management program.

1.7 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance Materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Supply two sets of wrenches for door closers, locksets, and fire exit hardware.

Part 2 Products

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.

.2 Manufacturer's listed in the door hardware schedule should be taken as the Standard of Acceptance.

.3 Door hardware supplier/installer to carefully review existing site conditions for retro-fitting of existing doors outlined in the Door Schedule, and shall provide hardware to suit site conditions and functionality outlined in Door Schedule notes for card reader retrofits.

2.2 DOOR HARDWARE (also refer to Hardware Schedule below)

.1 Locks and latches:

.1 Bored and preassembled locks and latches: to CAN/CGSB-69.17 or latest, with lever handles as stated in Hardware Schedule. Acceptable manufacturer is Best Access Systems & and Schlage ND Series.

.2 All locksets/latchsets with levers to have 70mm backset typically.

.3 All locksets/latchsets with knobs to have 127mm backset typically.

.2 Butts and hinges:

.1 Butts and hinges: to CAN/CGSB-69.18 or latest, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.

.2 Self-closing hinges and pivots: to CAN/CGSB-69.33 or latest, designated by letter K and numeral identifiers listed in Hardware Schedule, [with suffix letter F indicating listed for used on fire doors].

.3 Strap and tee hinges and hasps: to CAN/CGSB-69.36 or latest, designated by letter A and numeral identifiers listed in Hardware Schedule, size [listed in Hardware Schedule] [in accordance with CAN/CGSB 69.36 or latest, table I].

.4 Provide 1 ½ pair of butts for door up to 914mm (36”) wide x 2200mm (84”) high and 2 pairs of butts for doors larger than these dimensions.

.3 Door Closers and Accessories:

.1 Door controls (closers): to CAN/CGSB-69.20 or latest, designated by letter C and numeral identifiers listed in Hardware Schedule, in accordance with CAN/CGSB-69.20, table A1.

.2 Door controls - overhead holders: to CAN/CGSB-69.24 or latest, designated by letter C and numeral identifiers listed in Hardware Schedule.

.3 Closer/holder release devices: to CAN/CGSB-69.31 or latest, designated by letter C and numeral identifiers listed in hardware schedule.

.4 Weatherstripping:

.1 Head and jamb seal:

.1 Extruded aluminum frame and solid closed cell neoprene, clear anodized finish.

.2 Adhesive backed neoprene Material.

.2 Door bottom seal:

.1 Extruded aluminum frame and closed cell neoprene, clear anodized.

.3 Astragal: adjustable extruded aluminum frame with pile insert, finished to match doors.

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with Material through which they pass.

2.4 HARDWARE SCHEDULE (refer to drawings)

2.5 KEYING

.1 Keying shall be under existing Grand Master Key System as supplied by the Best Lock Company and Schlage C Keyways.

.2 Lock cylinders shall accommodate interchangeable/removable LFIC (Schlage) and SFIC (Best) cores as noted on the Hardware Schedule. Coordinate with the City of Winnipeg Contract Administrator.

.3 Hardware supplier shall supply the final key cores; the City will complete the final keying and install the keyed cores.

.4 Hardware supplier shall furnish required number of temporary construction cores and keys to Contractor for security purposes during construction.

.5 All keys to be stamped “Do Not Duplicate”

.6 Contractors shall maintain strict control over construction core and keys.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Furnish wood and metal door and frame manufacturers with complete instructions and templates for preparation of their Work to receive hardware.

.3 Furnish manufacturers' instructions for proper installation of each hardware component.

3.2 INSTALLATION

.1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.

.2 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.3 Furnish metal/wood door and frame manufacturers with complete instructions and templates for preparation of their Work to receive hardware.

.4 Furnish manufacturer's instructions for proper installation of each hardware component.

.5 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.6 Mounting heights: unless noted otherwise, use the following heights as a general guideline from the T/O of the finished floor to the C/L (centre line) of the item for compliance with City of Winnipeg Accessibility Guidelines:

.1 Door Pull – 3'-0"

.2 Door Bar – 3'- 0"

.3 Push Plate –4'-7"

.4 Lockset/Latchset – 3'-0"

.5 Panic Hardware – 3'-0" or as recommended by manufacturer

.6 Deadlock – 5'-0"

3.3 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to provide tight fit at contact points with frames.

3.4 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.

.3 Remove protective Material from hardware items where present.

.4 Upon completion of installation, remove surplus Materials, rubbish, tools and equipment barriers and provide written certification to the Contract Administrator that all hardware has been installed as specified.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 45 00 – Quality Control

.3 Section 01 61 00 – Common Product Requirements

.4 Section 01 77 00 – Closeout Procedures

.5 Section 01 78 00 – Closeout Submittals

.6 Section 04 05 10 – Common Masonry

.7 Division 08 – Openings

.8 Division 21 – Mechanical General Requirements

.9 Division 26 – Electrical

1.2 REFERENCES

.1 Master Painters Institute (MPI) Architectural Painting Specifications Manual, current edition.

.2 Systems and Specifications Manual, SSPC Painting Manual, Volume Two, Society for Protective Coatings (SSPC).

.3 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

.4 National Fire Code of Canada.

1.3 QUALITY ASSURANCE

.1 Contractor shall have a minimum of five (5) years proven satisfactory experience. When requested, provide a list of last three (3) comparable jobs including, job name and location, specifying authority, and project manager.

.2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting Work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.3 Conform to latest MPI requirements for interior painting Work including preparation and priming.

.4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.

.5 Other paint Materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating Materials as required.

.6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Contract Administrator.

.7 Standard of Acceptance:

.1 Walls and Vertical Surfaces (i.e. columns): No defects visible from a distance of 1000 mm at 90 deg to surface.

.2 Ceilings: No defects visible from floor at 45 deg to surface when viewed using final lighting source.

.8 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

.9 All painting and decorating work shall be inspected a Paint Inspection Agency (inspector) selected by the Contract Administrator. The painting subcontractor shall notify the Paint Inspection Agency a minimum of one week prior to commencement of work.

.10 All surfaces requiring painting shall be inspected by the Paint Inspection Agency who shall notify the Contract Administrator and Contractor in writing of any defects or problems, prior to commencing painting work, or after the prime coat shows defects in the substrate.

.11 Where “special” painting, coating or decorating system applications (i.e. non-MPI listed produts or systems) are to be used, the paint or coating manufacturer shall provide as part of this work, certification of all surfaces and conditions for specific paint or coating system application as well as on-site supervision, inspection and approval of their paint or coating system application as required at no additional cost to the City.

1.4 SCHEDULING OF WORK

.1 Submit Work schedule for various stages of painting to Contract Administrator for approval. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Contract Administrator for any changes in Work schedule.

.3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.5 SUBMITTALS

.1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with Section 01 33 00 - Submittal Procedures. List products according to the MPI system, substrate and location for review by the Contract Administrator and the Painting Inspection Agency.

.2 Upon completion, submit records of products used. List products in relation to finish system and include the following:

.3 Product name, type and use.

.4 Manufacturer's product number.

.5 Colour numbers.

1.6 SAMPLES

.1 Upon request, submit 300 x 300 mm sample panels of each paint, stain and special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted on the following substrate Materials:

.2 3 mm plate steel for finishes over metal surfaces.

.3 13 mm birch plywood for finishes over wood surfaces.

.4 50 mm concrete block for finishes over concrete or concrete masonry surfaces.

.5 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.

When approved, sample panels shall become acceptable standard of quality for appropriate On-Site surface with one of each sample retained On-Site.

1.7 QUALITY CONTROL

.1 When requested by Contract Administrator and/or Paint Inspection Agency, prepare and paint designated surface, area, room or item (in each colour scheme) to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar On-Site Work.

1.8 EXTRA MATERIALS

.1 Submit maintenance Materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit one - four litre can of each type and colour of stain and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Deliver to Site and store where directed by the City.

1.9 DELIVERY, HANDLING AND STORAGE

.1 Deliver, store and handle Materials in accordance with Section 01 60 00 - Basic Product Requirements.

.2 Labels shall clearly indicate:

.3 Manufacturer's name and address.

.4 Type of paint or coating.

.5 Compliance with applicable standard.

.6 Colour number in accordance with established colour schedule.

.7 Remove damaged, opened and rejected Materials from Site.

.8 Provide and maintain dry, temperature controlled, secure storage.

.9 Observe manufacturer's recommendations for storage and handling.

.10 Store Materials and supplies away from heat generating devices.

.11 Store Materials and equipment in a well ventilated area with temperature range 7 °C to 30 °C.

.12 Store temperature sensitive Products above minimum temperature as recommended by manufacturer.

.13 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Contract Administrator. After completion of operations, return areas to clean condition to approval of Contract Administrator.

.14 Remove paint Materials from storage only in quantities required for same day use.

.15 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of Hazardous Materials.

.16 Fire Safety Requirements:

.17 Provide one 9 kg Type ABC fire extinguisher adjacent to storage area.

.18 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.

.19 Handle, store, use and dispose of flammable and combustible Materials in accordance with the National Fire Code of Canada.

1.10 SITE REQUIREMENTS

.1 Heating, Ventilation and Lighting:

.2 Ventilate enclosed spaces.

.3 Perform no painting Work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 deg C for 24 hours before, during and after paint application until paint has cured sufficiently.

.4 Where required, provide continuous ventilation for seven (7) days after completion of application of paint.

.5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.6 Perform no painting Work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by Contractor.

.7 Temperature, Humidity and Substrate Moisture Content Levels:

.8 Unless specifically pre-approved by the specifying body and the applied product manufacturer, perform no painting Work when:

.1 Ambient air and substrate temperatures are below 10 °C.

.2 Substrate temperature is over 32 °C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is above 85% or when the dew point is less than 3 °C variance between the air/surface temperature.

.5 Perform no painting Work when the maximum moisture content of the substrate exceeds:

.6 12% for concrete and masonry (clay and concrete brick/block).

.7 15% for wood.

.8 12% for plaster and gypsum board.

.9 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

.10 Test concrete, masonry and plaster surfaces for alkalinity as required.

.9 Surface and Environmental Conditions:

.1 Apply paint finish only 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.

.2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint only when previous coat of paint is dry or adequately cured.

.10 Additional Interior Application Requirements:

.1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Paint, stain and wood preservative finishes and related Materials (thinners, solvents, etc.,) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.2 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.3 Place Materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.4 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground the following procedures shall be strictly adhered to:

.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 an approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.5 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.6 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

1.12 PROTECTION

.1 Adequately protect other surfaces from paint and damages. Make good any damage as a result of inadequate or unsuitable protection.

PART 2 Products

2.1 MATERIALS

.1 Acceptable general products/manufacturers are:

.1 ICI/Dulux

.1 Dulux Lifemaster

.2 Devflex/Devguard

.3 Glidden Pro

.4 Weatherguard

.2 Cloverdale Paint:

.1 Eco-Logic Series

.2 Multi-Master

.3 General Paint (GP)

.1 Enviroguard series.

.2 Z-Coat Enviro-Friendly

.4 Wooster Products Inc.

.1 Epoxy WP-70 Anti slip coating

.1 Allow for 2 colours: Black and Safety Yellow

NOTE: All other paint Materials shall be listed in the MPI Approved Products List (APL).

.2 Only paint Materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.3 Paint Materials for paint systems shall be products of a single manufacturer.

.4 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this project. Use E3 rated products where possible.

.5 Paints, stains, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall:

.1 Be water-based unless otherwise specified.

.2 Be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.

.3 Do not contain toxic metal pigments.

.4 Have a recycled content if cost neutral.

.6 Water-borne surface coatings must be manufactured and transported in a manner that steps of process, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

.7 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

.8 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.0°C or greater.

.9 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:

.1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.10 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.

.11 Recycled water-borne surface coatings must not contain:

.1 Lead in excess of 600.0 ppm weight/weight total solids.

.2 Mercury in excess of 50.0 ppm weight/weight total product.

.3 Cadmium in excess of 1.0 ppm weight/weight total product.

.4 Hexavelant chromium in excess of 3.0 ppm weight/weight total product.

.5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

.12 The following must be performed on each batch of consolidated post-consumer Material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.

.1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.

.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.

.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

2.2 COLOURS

.1 Paint:

.1 Provide to the Contract Administrator colour fans (samples) of manufacturer.

.2 Colour selection will be based on two (2) base colours, and one (1) accent colours with a maximum of one (1) deep or bright colours. No more than three (3) colours will be selected for the entire project, and no more than three (3) colours will be selected in each area.

.3 Paint colours will be selected by the Contract Administrator. One (1) copy of the colour schedule will be provided to the Contractor prior to commencement of painting operations.

.4 Maintain one copy of the colour schedule on Site during painting.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to Site. On-site tinting of painting Materials is allowed only with Contract Administrator's written permission.

.2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.

.3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

.4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Contract Administrator.

.5 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.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level Category	Units @ 60 deg	Units @ 85 deg
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

.2 Gloss level ratings of painted surfaces shall be as specified herein.

2.5 EXTERIOR PAINTING SYSTEMS

.1 Exterior Concrete / Concrete Masonry Units (CMU) – Elastomeric Coating: to MPI EXT 4.2D

.1 Surface preparation:

.2 One (1) coat elastomeric coating (MPI #113)

2.6 INTERIOR PAINTING SYSTEMS - GENERAL

.1 Concrete / concrete masonry unit (CMU) walls: to MPI INT 4.2A

.1 One (1) coat latex block filler/primer (MPI #4)

.2 Two (2) finish coats of acrylic latex to Gloss level G3.

.2 Structural steel and metal fabrications exposed (not galvanized): to MPI INT 5.1Q

.1 One (1) coat spot primer

.2 One (1) coat alkyd primer (MPI #76)

.3 Two (2) finish coats of acrylic latex to Gloss level G5 typical (except to Gloss level G1 at ceilings) (MPI #54)

.3 Galvanized steel: doors, frames, railings, misc. steel, pipes: to MPI INT 5.3M

.1 One (1) coat waterborne galvanized primer (MPI #134)

.2 Two (2) two finish coats of high performance architectural latex to Gloss level G5 (MPI #141)

PART 3 Execution

3.1 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.

.2 Apply paint Materials in accordance with paint manufacturer's written application instructions.

3.2 EXISTING CONDITIONS

.1 Prior to commencement of work of this Section, thoroughly examine (and test as required) all conditions, surfaces, and existing substrates for problems related to proper and complete preparation of surfaces to be painted, and conditions that will adversely affect the Work of this Section. Report to Contract Administrator any damages, defects, unsatisfactory or unfavourable conditions before proceeding with Work.

.2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Contract Administrator. Do not proceed with Work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:

.1 Stucco, Plaster and Gypsum Board: 12%.

.2 Concrete: 12%.

.3 Clay and Concrete Block/Brick: 12%.

.4 Wood: 15%.

3.3 PROTECTION

.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 such surfaces as directed by Contract Administrator.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect passing pedestrians and general public about the building.

.5 Removal of electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking any painting operations by Contractor. Items shall be securely stored and re-installed after painting is completed by Contractor.

.6 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

3.4 CLEANING AND PREPARATION

.1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by vacuuming or wiping with dry, clean cloths.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.

.2 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.

.3 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.4 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.

.5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by blowing with clean dry compressed air, or vacuum cleaning.

.6 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated Material.

.7 Substrate defects shall be made good and sanded by others ready for painting particularly after the first coat of paint. Start of finish painting of defective surfaces (e.g. gypsum board) shall indicate acceptance of substrate and any costs of making good defects shall be borne by the painting subcontractor including re-painting of the entire defective surface (no touch up painting).

.8 Do not apply paint until prepared surfaces have been accepted by Contract Administrator.

3.5 APPLICATION

.1 Apply paint and other finishes in accordance with MPI Painting Manual Premium Grade finish requirements.

.2 Brush and Roller Application:

.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Contract Administrator.

.5 Remove runs, sags and brush marks from finished Work and repaint.

.3 Apply paint in a workmanlike manner using skilled and trade qualified applicators.

.4 Apply each coat at the proper consistency.

.5 Each coat of paint is to be slightly darker than the preceding coat, unless otherwise approved by the Contract Administrator.

.6 Unless otherwise approved, apply a minimum of four (4) coats of paint where deep or bright colours are used to achieve satisfactory results.

.7 Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1000mm (39”).

.8 Do not apply finishes on surfaces that are not sufficiently dry. Unless manufacturer’s directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.

.9 Paint finish shall continue through behind all wall-mounted items (re: white and tack boards).

.10 Where clear finishes are required, ensure tint fillers match wood. Work fillers well into the grain before it has set. Wipe excess from the surface.

.11 Back prime interior woodwork, which is to receive a paint or enamel finish, with enamel undercoat paint.

.12 Back prime interior woodwork, which is to receive stain and/or varnish finish, with a gloss varnish, reduced by twenty-five percent (25%) with mineral spirits.

.13 Apply enamel undercoat to all primed and galvanized/zinc coated doors, frames, etc.

.14 Prime top and bottom edges of metal doors with enamel undercoater when they are to be painted.

.15 Prime top and bottom edges of wood doors with gloss varnish when they are to receive a stain or clear finish.

.16 Paint tops of low partitions (partitions stopping below ceiling height).

.17 At locations where demolition has exposed previously unpainted surfaces, provide additional base coats so new finish will blend with adjacent painted surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Unless otherwise specified, prime and paint finished area exposed insulated and bare pipes, conduits, piping, hangers, brackets, collars, and supports, except where items are plated or covered with a pre-finished cladding. Paint to colours of adjacent walls, ceiling etc. to Contract Administrator's direction.

.2 In service rooms, leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.3 Colour coding of equipment, piping, conduit, and exposed ductwork: All colour banding and identification (flow arrows, naming, etc.) shall be coordinated with Mechanical and Electrical Subcontractors.

.4 For hot surfaces, such as hot water piping, use "Bonding Primer' and "industrial Enamel' for heat-resistant primer and finish.

.5 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.6 Do not paint over nameplates.

.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint, extending min. 450mm behind grille.

.8 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.9 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.10 All mechanical equipment including equipment on roof shall be cleaned and coated with semi-gloss latex.

.11 Do not paint interior transformers and substation equipment.

3.7 RESTORATION

.1 Clean and re-install all hardware items removed before undertaking painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Contract Administrator. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Contract Administrator.

3.8 CLEANING

.1 As the Work proceeds, and upon completion, promptly remove all paint where spilled, splashed, spattered, or sprayed, using means and Materials that are not detrimental to affected surfaces.

.2 During the progress of Work, keep premises free from any unnecessary accumulation of tools, equipment, surplus Materials and debris.

.3 Remove combustible rubbish Materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.

.4 Upon completion of Work, leave premises neat and clean, to the satisfaction of the Contract Administrator.

3.9 ACCENT & DEEP COLOURS

.1 Contract Administrator to provide colour schedule and diagrams for locations of accent colour finishes, bands and wall areas, super-graphics, etc. Note that deep tone colours may be required as per the colour schedules.

.2 Use deep tone primers for deep tone colours.

3.10 SITE TOLERANCES

.1 Painting surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:

.1 Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 39”.

.2 Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 39”.

.3 Visible defects are evident on ceiling, soffit or other overhead surfaces when viewed at normal viewing angles.

.4 When final coat on any surface exhibits a lack of uniformity of colour, sheen, texture, and hiding across full surface area.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Documents and certain applicable terminology.

.2 Associated requirements.

.3 Work expectations.

.4 Work by other parties.

.5 Words and terms.

.6 Examination

.7 Closeout submittals

.8 Operation and maintenance manual format.

.9 Contents each volume.

.10 Recording actual site conditions.

.11 Record documents.

.12 Warranties and bonds.

.13 Quality Assurance.

.14 Demonstration and Training

.15 Conditions for Demonstrations

.16 Shop drawings and product data.

.17 Samples.

.18 Certificates and transcripts.

.19 Product quality, availability, storage, handling, protection, and transportation.

.20 Product changes and substitutions.

.21 Manufacturer's instructions.

.22 Quality of Work, coordination and fastenings.

.23 Accessibility of Equipment

.24 Coordination, work for other trades, electrical requirements, temporary use of equipment.

.25 Existing facilities.

1.2 Related Sections

.1 Applicable sections in Division 01, including:

- .1 Construction Progress Documentation.
- .2 Submittal Procedures.
- .3 Product Exchange Procedures.
- .4 Substitutions
- .5 Closeout Submittals.

.2 This section describes common work applicable to all Sections within project Divisions 21, 22, 23 and 25.

1.3 Complementary Documents

.1 Drawings, specifications, and schedules are complementary to each other and what is called for by one will be binding as if called for by all.

.2 Should any discrepancy appear between the drawings and specifications, which leaves the Contractor in doubt as to the true intent and meaning of the plans, and specifications, the Contractor shall obtain a ruling in writing from the Contract Administrator in writing before submitting the bid. If this is not done it will be assumed that the most expensive alternative has been included in the bid price.

.3 The drawings for mechanical work are performance drawings. They are generally diagrammatic and are not to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions showing every offset, fitting, valve or every difficulty encountered during execution of work and will not be used as an excuse for deficiencies or omissions. Where required installations are not shown on plans or are only shown diagrammatically, install in such a way as to conserve headroom and interfere as little as possible with free use or space through which they pass, while adequate space is allowed for service, maintenance, repair, or replacement for all equipment.

.4 Drawings indicate general location and route of new and existing mechanical systems. The review of exact location and routing of systems prior to bidding is the responsibility of the Contractor. Install piping and duct systems not exactly shown in plan or indicated by note, by graphic, or diagrammatically in schematic or riser diagrams to provide an operational assembly or system.

.5 Install components to physically conserve headroom, to minimize furring spaces, to accommodate installed Work, or other obstructions.

.6 Install ceiling mounted or exposed mechanical components such as diffusers, sprinkler heads and grilles in accordance with reflected ceiling drawings or floor plans.

.7 Locate devices with primary regard for convenience of operation and usage.

.8 Examine all discipline drawings, specifications, and schedules and related Work to ensure that Work can be satisfactorily executed. Conflicts or additional Work beyond Work described, to be brought to the attention of the Contract Administrator.

.9 All specification sections of the Project Manual and Drawings are affected by requirements of Division 01 sections.

1.4 Description Of The Work

.1 Division of the Work among other contractors, subcontractors, suppliers or vendors is solely the Contractor's responsibility. Neither The City nor Contract Administrator assumes any responsibility to act as an arbiter to establish subcontract terms or disagreements between sectors or disciplines of the Work.

1.5 Contract Method

.1 Construct Work under the contract requirements in the applicable Division 00 sections.

.2 Contract Documents were prepared by the Contract Administrator for The City. Any use which a third party makes of the Contract Documents, or any reliance on or decisions to be made based on them, are the responsibility of such third parties. The Contract Administrator accepts no responsibility for any damages suffered by any third party as a result of decisions made or actions based on the Contract Documents.

1.6 Permits, Inspection And Testing

.1 File all necessary notices and approved layouts, obtain and pay for all Local Authority and Fire Underwriters Inspections, approvals and permits applicable to each Mechanical Section. Make changes required to secure Local Authorities approval, without extra cost.

Where conflicting requirements occur, comply with most stringent regulation. Note that requirements shown or specified may exceed minimum standards set by Local Authorities.

.2 The Regulations of the A.S.M.E. Code and the Provincial Labour Department shall cover the design, manufacture, installation, welding and tests of piping and other equipment as specified hereafter.

.3 Obtain Registration Certificates for all pressure vessels, with suitable metal-framed glass covers installed where directed. Furnish all certificates required by Local Authorities before acceptance of building by The City.

.4 The City may request the Mechanical Section to operate device or material installed for such time as Contract Administrator may require, as a thorough test, before final acceptance. Such tests shall not be construed as evidence of acceptance, and no claim for cost of such operation for test, or damage due to inadequacy or defect will be recognized.

.5 Note that site reviews by the Contract Administrator are for the purpose of determining in general if the work is proceeding in accordance with the Contract Documents, and to endeavour to guard The City against defects and deficiencies and not to superintend the execution of the work, which is the Mechanical Contractor's and their Subcontractors' responsibility.

1.7 Words And Terms

.1 Conform to definitions and their defined meanings as in C1.

.2 Refer to C1 for Specification Grammar.

.3 Conform to the following definitions and their defined meanings in addition to those referenced in C1:

.1 Install: To remove from site storage, move or transport to intended location, install in position, connect to utilities, repair site caused damage, and make ready for use.

.2 Supply: To acquire or purchase, ship or transport to the site, unload, remove packaging to permit inspection for damage, re-package, replace damaged items, and safely store on-site.

.3 Provide: Wherever the term "provide" is used in relationship to equipment, piping and other materials specified for the work, it means "supply, install and connect". Wherever the terms "provide" is used in connection with services such as testing, balancing, start-up, preparation of drawings for any part of the work, it means procure, prepare, supervise, take responsibility for, and pay for these services.

.4 Typical: A representative characteristic that is standard for all installations whether individually noted or not throughout the documents. "Typical" applies to each individual or combined installation except where specifically noted or otherwise indicated that the application is non-typical.

.5 Exposed: Any work not concealed in wall, shaft, or ceiling cavities or spaces. Work behind doors, in closets or cupboards or under counters is considered exposed.

.6 New: Produced from new materials.

.7 Renewed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.

.8 Defective: A condition determined exclusively by the Contract Administrator.

1.8 Examination

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

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

.3 Examine all contract documents to ensure work can be performed without changes to the Work as shown on plans. No allowance will be made later for necessary changes, unless notification of interferences have been brought to Contract Administrator's attention in writing, prior to bid closing.

.4 Verify that materials and equipment can be delivered to the place of the work and that sufficient space and access is available to permit installation as shown on the drawings.

.5 Verify the locations and inverts of service lines leaving and entering building to ensure their proper function prior to commencing work.

1.9 Closeout Submittals

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

.2 Four (4) weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, three (3) final copies of operating and maintenance manuals in Canadian English.

.3 Copy will be returned with Contract Administrator's comments.

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

.5 Two (2) weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, three (3) final copies of operating and maintenance manuals, revised as per Contract Administrator's comments.

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

.7 If requested, furnish evidence as to type, source and quality of products provided.

.8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.9 Pay costs of transportation.

1.10 Operation And Maintenance Manual Format

.1 Refer also to Section 01 78 00 for formats for manuals. Where there is a discrepancy with this section, follow the requirements of 01 78 00.

.2 Organize data in the form of an instructional manual.

.3 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 8.5 x 11 inch (219 x 279 mm) with spine and face pockets.

.4 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

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

.6 Arrange content by systems under Section numbers and sequence of Table of Contents.

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

.8 Text: Manufacturer's printed data, or typewritten data.

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

1.11 Contents - Each Volume

.1 Refer also to Section 01 78 00 for formats for contents. Where there is a discrepancy with this section, follow the requirements of 01 78 0.

.2 Table of Contents: Provide:

.1 Title of project.

.2 Date of submission.

.3 Names, addresses, and telephone numbers of Contract Administrator and Contractor with name of responsible parties.

.4 Schedule of products and systems, indexed to content of volume.

.3 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.4 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.

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

.6 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including code compliance certificate, life safety systems performance certificate. pressure vessel acceptance.

.7 Training: Refer to Demonstration and Training in this Section.

1.12 Recording Actual Site Conditions

.1 Record information on a full-sized set of drawings, and within the Project Manual.

.2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording changed information.

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

.4 Contract drawings and shop drawings: legibly mark each item to record actual construction, including:

.1 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.2 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.3 Field changes of dimension and detail.

.4 Changes made by change orders.

.5 Details not on original Contract Drawings.

.6 References to related shop drawings and modifications.

.5 Specifications: legibly mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: Maintain manufacturer's certifications, inspection certifications, field test records required by individual specifications sections.

1.13 Record Documents

.1 Prior to Substantial Performance of the Work, electronically transfer the marked-up information from the as-built documents, as follows:

.1 Drawings: Scan the full-sized field-verified as-built drawing set and save to PDF format. Scans shall be in colour and with good resolution to ensure drawings and markups are legible.

.2 Specifications: Adobe Acrobat (PDF).

.2 Mark revised documents as "RECORD DOCUMENTS". Include all revisions.

.3 Submit completed record documents to Contract Administrator on a CD, DVD, or by electronic transfer.

1.14 Warranties And Bonds

.1 Refer also to Section 01 78 00 for Warranties and Bonds.

.2 Provide written guarantee that complete installation including materials, work and operation of all equipment provide under Mechanical Sections are first class in every respect, subject only to improper usage by The City, and make good forthwith when reported all defects which develop within one year from date of acceptance of building by The City at no additional cost to The City.

.3 In addition, guarantee heating and cooling systems through one complete heating or cooling season, as applicable.

.4 Deliver to The City all equipment manufacturer's guarantees specified in excess of one year.

1.15 Fabrication And Workmanship

.1 Employ skilled mechanics in their respective trades, under competent supervision, and where required by Provincial or Local regulations holder of acceptable qualification certificates.

1.16 Quality Assurance

.1 Provide testing organization services as specified in subsequent Sections.

.2 Testing organization: Current member in good standing of their respective professional or industry organization and certified to perform specified services.

.3 Comply with applicable procedures and standards of the certification sponsoring association.

.4 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

.5 Qualifications:

.1 Provide adequate workforce training through meetings and demonstrations.

.2 Provide a designated experienced person on site with de-construction experience throughout the project for consultation and supervision purposes.

1.17 Demonstration And Training

.1 Instruct The City's designated employees in proper care, operation, use and maintenance of all systems and equipment, and provide general explanatory literature required and start up supervision and instructions.

.2 Provide two (2) weeks prior notice to The City to schedule the training.

.3 The City will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

.4 Upon completion of instructions, forward to Contract Administrator with a copy to The City a letter indicating person instructed and dates that the instruction took place. If in Contract Administrator's opinion, this is not done satisfactorily, Contract Administrator may direct such instruction, and charge all costs involved to relevant section.

1.18 Conditions For Demonstrations

.1 Equipment has been inspected and put into operation in accordance with related sections.

.2 Testing, adjusting, and balancing have been performed and equipment and systems are fully operational.

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

1.19 Shop Drawings - Administrative Requirements

.1 Shop drawings shall be submitted electronically in PDF format documents to shopdrawings@eppsiepman.com.

.2 Shop drawing documents shall be grouped by specification section. Clearly list the specification section on the front page or cover sheet of the submittal. Shop drawings related to multiple sections may not be grouped together into a single document. Documents that are groups incorrectly will be returned without being examined and shall be considered rejected.

.3 Each drawing shall include the name of project as found on the drawings or specifications, the equipment supplier and the specification section that the equipment is specified under.

.4 Submit to Contract Administrator submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 Work affected by submittal shall not proceed until review is complete.

.6 Present Shop Drawings, product data, samples and mock-ups in SI Metric and/or Imperial inch-pound units, to match the units used in the schedules.

.7 Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.

.8 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.

.9 Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

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

.11 Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.

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

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

1.20 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 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. Indicate layouts, quantity, details of equipment, control wiring diagrams, sizes, capacities and roughing in and exact requirements for concrete pits, bases and other supporting members.

.3 Each shop drawing must be certified by manufacturer and as such shall indicate that all product engineering has been performed to ensure the product will meet the requirements of the intended installation.

.4 Shop drawings for grilles, registers and diffusers shall be accompanied by an itemized list indicating the unit locations by room number and the unit size.

.5 Allow fifteen (15) working days for Contract Administrator's review of each submission.

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

.7 Make changes in Shop Drawings as Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify Contract Administrator in writing of any revisions other than those requested.

.8 Accompany submissions with transmittal letter, containing:

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

.9 Submissions shall 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 other parts of the Work.

.10 After Contract Administrator's review, distribute copies.

.11 Submit one (1) copy of Shop Drawings as a pdf document by email attachment for each requirement requested in specification Sections and as consultant may reasonably request. Any electronic copy of shop drawings shall bear all the required marks of certification and approval by the manufacturer and contractor(s) as indicated above. The consultant will review and mark up one copy of the shop drawing, and return to the contractor by email attachment. The contractor shall then make copies as required for ordering and documentation purposes. Multiple copies of shop drawings will not be returned.

.12 Submit one electronic copy of product data sheets or brochures for requirements requested in specification sections and as requested by Contract Administrator where Shop Drawings will not be prepared due to standardized manufacture of product. Submittals shall be submitted as a pdf document by email attachment, or delivered as a hard copy. Any electronic copy of shop drawings shall bear all the required marks of certification and approval by the manufacturer and contractor(s) as indicated above.

.13 Delete information not applicable to project.

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

.15 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, one electronic copy will be returned and fabrication and installation of Work may proceed. If Shop Drawings are rejected, noted copy will be returned and re-submission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed. The contractor shall then make copies as required for ordering and documentation purposes. Multiple copies of shop drawings will not be returned.

.16 Checking of shop drawings by the Contract Administrator does not constitute acceptance of responsibility. Such checking constitutes assistance only to the Mechanical Division in the proper execution of their work.

1.21 Samples

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

.2 Deliver samples prepaid to Contract Administrator's business address unless otherwise instructed.

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

.6 Make changes in samples which Contract Administrator 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.

1.22 Mock-up

.1 Erect mock-ups to the requirements of Division 01.

1.23 PROGRESS PAYMENT SUBMISSIONS

.1 Submit progress payment breakdowns for review by the Contract Administrator to the requirements of Division 01.

.2 For mechanical submissions, provide line item breakdowns to indicate the following:

.1 Equipment progress payments for Fire Protection, Plumbing, Hydronic and HVAC.

.2 Labour progress payments for Fire Protection, Plumbing, Hydronic and HVAC.

.3 Controls

.4 Insulation

.5 Air Balancing

.6 Commissioning, Start Up and Training

.7 Close out documents – Record drawings, Operation and Maintenance documents.

1.24 Product Quality

.1 Products, materials, equipment, parts or assemblies (referred to as Products) incorporated in Work: New, not damaged or defective, of best quality (compatible with specification requirements) for purpose intended. If requested, provide evidence as to type, source and quality of Products provided.

.2 Defective Products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should any dispute arise as to quality or fitness of Products, decision rests strictly with Contract Administrator.

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

.5 Permanent labels, trademarks and nameplates on Products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.25 Availability

.1 Immediately upon signing Contract, review Product delivery requirements and anticipate foreseeable supply delays for any items.

.2 If delays in supply of Products are foreseeable, notify Contract Administrator of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.3 In event of failure to notify Contract Administrator at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Contract Administrator reserves right to substitute more readily available Products of similar character, at no increase in Contract Price or Contract Time.

1.26 Storage And Protection

.1 Store and protect Products in accordance with manufacturers' written instructions.

.2 Store with seals and labels intact and legible.

.3 Store sensitive Products in weather tight, climate controlled, enclosures in an environment favourable to Product.

.4 For exterior storage of fabricated Products, place on sloped supports above ground.

.5 Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.

.6 Cover open ends of pipes, fixtures, ductwork, etc. to prevent entry of building rubbish.

.7 Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

.8 Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

.9 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.27 Transportation And Handling

.1 Transport and handle Products in accordance with manufacturer's written instructions.

.2 Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.

.3 Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

.4 Protect all finished and unfinished work from soiling or damage, cover floors with tarpaulins or plywood as necessary, and repair any damage resulting from work of Mechanical Section.

.5 Protect finished surfaces to remain exposed, by paper, polyethylene or other satisfactory removable protective covering using paste acceptable to fixture manufacturer to prevent possible damage to finishes, until all reason for construction damage has passed and until acceptance by The City, and make good any such damage.

1.28 Special Cleaning

.1 Maintain tidiness within work of Mechanical Sections and at completion remove protective paper, labels, etc. and tools and waste materials. Leave clean and in perfect operating condition.

.2 Remove dirt, rubbish, grease, and dust for which this section is responsible from all exposed surfaces and fixtures.

.3 Operate, drain and flush out bearings and refill with new charge of lubricant, before final acceptance.

.4 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances within the scope of work area. Disconnect, clean and reconnect whenever necessary for purpose of locating and removing obstructions. Repair work damaged in course of removing obstructions. Refer to 23 31 00 for any additional duct cleaning requirements.

.5 Clean exposed surfaces of mechanical equipment, ductwork, piping, etc., and polish plated work.

.6 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install extended nipples to outside of bearing enclosures for lubrication purposes.

.7 Remove tools, surplus, and waste material from the building site upon completion of work. Clean grease, dirt, and excess material from walls, floors, ceilings, surfaces, and

fixtures for which this Contractor was responsible, and leave the premises suitable for immediate use.

.8 At the end of construction all systems shall be left ready for operation.

.9 This Section shall be responsible for repair work as may be necessary to remove dents and touch-up of factory finishes.

1.29 Product Changes & Substitutions

.1 Change in Product/Products: Submit request for substitution or alternative in accordance with this Section, the Instructions to Bidders, and Division 01 Product Exchange Procedures Division 01 Substitutions Sections, and Bidding Procedures B7 - Substitutes. In case of a discrepancy between this section and Division 00 and Divisions 01, the more stringent requirements shall apply.

.2 The Instructions to Bidders specify time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this section.

.3 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

.4 Any substituted item submitted for consideration must not exceed the available space and weight limitations, and all additional costs for mechanical, electrical, structural and architectural revisions required to incorporate the substituted material shall be the responsibility of the Mechanical Division. Review maximum dimensions and weights when provided in the specification and schedules, and where not specified review the drawings for space limitations.

.5 A request constitutes a representation that the Bidder:

.1 Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.

.2 Will provide the same warranty for the Substitution as for the specified Product.

.3 Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to The City.

.4 Waives claims for additional costs or time extension which may subsequently become apparent.

.5 Will reimburse The City and Contract Administrator for review or redesign services associated with re-approval by authorities.

.6 Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

1.30 Existing Utilities

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to the Work, building occupants, or pedestrian or vehicular traffic.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

1.31 Manufacturer's Written Instructions

.1 Unless otherwise indicated in the specifications, install or erect Products to manufacturer's written instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.

.2 Notify Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that Contract Administrator may establish course of action.

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

1.32 Quality Of Work

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Contract Administrator if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Contract Administrator reserves right to require dismissal from site any workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Contract Administrator, whose decision is final.

.4 Assume full responsibility for layout of own work and for any damage caused to property of others through improper location or poor workmanship.

1.33 Accessibility Of Equipment

.1 The City places a high priority on being able to safely and efficiently gain access to systems and equipment for replacement and repair. All equipment must be accessible, as defined as follows:

.1 Ceiling mounted equipment shall only be considered accessible if a tradesman can place both hands on the equipment components which requires services (ie: fan motor, belt, pulley, bearing, fire damper linkages, valve/control valve, strainer or any other equipment component which requires periodic maintenance). The component must be in clear view, and access must be gained from an 8 or 10 foot step ladder. Access panels provided in drywall shall be sized and placed in such a manner that trades personnel can place two hands on the equipment components as stated above. Equipment located above acoustic tile ceiling shall be positioned in such a manner that equipment and its components can be accessed through a full tile which does not contain any devices such as light fixtures, speakers, smoke detectors or sprinkler heads. If this is not possible, it should be reviewed by the Contract Administrator/The City before deemed acceptable.

.2 Conduit, pipe, ducting and support racking or any other obstruction to accessibility shall be relocated at the contractor’s expense by the contractor’s forces.

1.34 Coordination

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

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

.3 Check levels shown before commencement to ensure adequate falls for sewers and pipes and report discrepancies immediately. Failure to so check and report does not relieve this section from responsibility for consequent extra expenditures.

.4 Where space is indicated as reserve for future equipment, leave clear and install piping and other work so that connections can be made to future equipment.

.5 Secure approval where necessary to cut holes in either finished or unfinished work, employ section whose work is involved, cut openings no larger than necessary and

without damage to adjoining work and carefully repair all damage to match adjacent work. Note the Mechanical Division is responsible for all required cutting and patching relating to this Contract, except as specifically noted otherwise.

.6 Provide and set bolts, templates, sleeves and fixing materials for fixing work under this section securely to work provided under other sections, in advance of other work, where required.

.7 Locate all openings in walls, partitions, beams, etc. required for installation of ducts, pipes and equipment, etc. specified in this section of the specifications and frame all openings as required.

.8 Installation of all equipment shall allow sufficient space to facilitate ease of maintenance. Clearance space shall allow for the removal of all components of equipment without hindrance. Where clearance requirements are not shown on the mechanical plans, manufacturer clearances must be maintained at a minimum.

1.35 Work For Other Trades

.1 The Mechanical Contractor shall install rough-ins and/or connections for all equipment requiring mechanical services, as shown on drawings or mentioned elsewhere in the specifications.

.2 Supply other trades with all necessary details, rough-in drawings, wiring diagrams, etc. as required.

1.36 Electrical Requirements

.1 Motors and electrical equipment supplied under Mechanical Division shall comply with Electrical Section and electrical characteristics scheduled or shown.

.2 See "Installation and Wiring Controls" in Electrical Section for equipment supplied under Electrical Section.

.3 The Electrical section shall provide starters for all motors and wire from starters to motors, unless otherwise indicated.

.4 The Electrical section shall wire between starters and switching components such as relays, float switches, and pressure switches.

.5 Supply to Electrical Section within four (4) weeks after contract award, fully detailed diagrams of power and control wiring required for equipment supplied by Sections 21 – 25.

.6 Motors shall be squirrel cage induction type 1800 RPM unless otherwise noted. Where dampness occurs, all motors and electrical apparatus such as float switches, etc. supplied integrally with any piece of apparatus, shall be totally enclosed.

.7 All motors 1 hp and larger shall be high efficiency as defined in CSA C390.

1.37 Concealment

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

.2 Before installation, inform Contract Administrator if there is interference. Install as directed by Contract Administrator.

1.38 Access Panels

.1 Provide in ample time for installation under relevant sections all necessary access panels in walls and ceilings to allow access to dampers, valves, etc., size 300 mm x 300 mm (12" x 12") min. or as required for proper maintenance with steel panel and frame, similar to Acudor, type to suit application. Instruct relevant section for proper location of access panels. Final locations subject to Contract Administrator's approval. ULC approved

access panels must be provided where access is through or into a fire partition or assembly. If access doors have been specified by architectural sections the architectural specification shall supersede this section.

1.39 Remedial Work

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

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

1.40 Alteration Work

.1 Where work is to be done in existing buildings, accurately survey, provide for avoidance of damage and interference to existing work and rectify any such damage due to work under Mechanical Sections. Accept existing work as it exists at time of tendering.

.2 Carefully dismantle existing mechanical equipment to be removed or relocated. Temporarily disconnect, remove, and reinstall existing equipment, piping, ductwork, conduit, light fixtures, and similar items, which interfere with the new installation after completion of new work or of existing installations to be demolished. Store equipment and materials on the premises as directed by The City.

.3 All usable salvaged equipment and materials shall remain the property of The City unless specifically noted otherwise. Such material shall be removed from the building and be safely and neatly stored on the site for removal by The City. The Contractor shall remove all rejected salvage from the site and legally dispose of it off site.

.4 Reuse existing equipment in new work after first repairing and reconditioning any defective items where noted. Safely cap and seal disconnected mechanical services within finished surfaces.

.5 The abandonment of existing equipment and material in place is not acceptable. All redundant services are to be removed back to active mains, which shall then be capped at existing point of connection.

.6 All mechanical equipment conflicting with new equipment being installed shall be moved or disconnected, without damage, by Contractor and shall remain property of The City. Remove ducts and piping not required in revised systems and interfering with new installation. This material shall become property of Contractor.

.7 Disconnect existing equipment indicated, intended to be reused, rough-in in new position, and after replacement connect fully, ready for use.

.8 Removal and relocation of mechanical equipment by relevant Mechanical Sections.

1.41 Location Of Fixtures

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

.2 Inform Contract Administrator of conflicting installation. Install as directed.

1.42 Fastenings

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

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.43 Fastenings - Equipment

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use Type 304 or 316 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.44 Temporary Use Of Equipment

.1 No portion of any mechanical system or equipment provided under Mechanical Sections may be used for temporary heating without Contract Administrator's written permission and observance of the following procedure:

.1 Oil and grease motor, fan and pump bearings, etc. check on a regular basis and maintain as recommended by manufacturer.

.2 Maintain and clean when necessary cleanable type filters and clean and oil just prior to take-over of building by The City. Replace throwaway type filters.

.3 Ensure that mechanical air handling equipment is not operated during painting.

.4 Employ equipment manufacturers and subtrades to ensure and certify that all systems and equipment are in proper condition, and guarantee all work used prior to take-over as for new work, from date of acceptance of building by The City.

.5 If permission for temporary use of mechanical equipment is granted, use Canadian Plumbing and Mechanical Contractors Association standard form of agreement as basis of responsibilities. Guarantee on complete installation shall not start until acceptance of building by The City.

.2 All return air grilles/openings shall be equipped with MERV 8 filters to keep return air system clean of dust and dirt if air handling equipment is being used before turnover to The City.

1.45 Protection Of Work In Progress

.1 Prevent overloading of any part of the Project.

.2 Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated, without written approval of Contract Administrator.

1.46 Equipment Start Up, And Verification Reports

.1 The contractor shall supply the equipment start-up reports for the mechanical equipment being installed.

.1 Forms shall be filled out in full, with all required and suggested fields.

.2 Forms shall include tester’s signature and the signature by the project manager for the mechanical contractor.

.2 The controls contractor shall supply a completed sequence verification checklist confirming all points of the system are functioning, reporting, and properly executing the sequence operation.

.1 Forms shall be developed and filled out by the contractor

.2 Forms shall include tester's signature and the signature by the project manager for the mechanical contractor.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Pipe, fittings, valves, and connections for sprinkler.

.2 Back flow prevention

1.2 Related Sections

.1 Submittal Procedures.

.2 Product Requirements.

.3 Closeout Submittals.

.4 Section 09 90 00 – Painting.

.5 Section 21 13 00 - Sprinklers.

.6 Section 23 05 53 - Mechanical Identification.

.7 Section 23 05 29 - Supports and Anchors.

1.3 REFERENCES

.1 ASME Boiler and Pressure Vessel Code Section IX - Welding and Brazing Qualifications.

.2 ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

.3 ASME B16.3 - Malleable Iron Threaded Fittings.

.4 ASME B16.4 - Cast Iron Threaded Fittings.

.5 ASME B16.5 - Pipe Flanges and Flanged Fittings.

.6 ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings.

.7 ASME B16.11 - Forged Fittings Socket Welding and Threaded.

.8 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

.9 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.10 ASME B16.25 - Buttwelding Ends.

.11 ASME B36.10 - Welded and Seamless Wrought Steel Pipe.

.12 ASTM A135 - Electric-Resistance-Welded Steel Pipe.

.13 ASTM A47/A47M - Ferritic Malleable Iron Castings.

.14 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.

.15 ASTM A234/A234M - Piping Fittings of Wrought-Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

.16 ASTM A795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

.17 ASTM B32 - Solder Metal.

.18 ASTM B75/B75M - Seamless Copper Tube.

.19 ASTM B88 - Seamless Copper Water Tube.

.20 ASTM B251 - General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.

.21 AWS A5.8 - Filler Metal for Brazing and Braze Welding.

.22 AWS D10.10 - Recommended Practices for Local Heating of Welds in Piping and Tubing.

.23 AWWA C110 - Ductile-Iron and Gray-Iron Fittings 76 mm through 1219 mm (3 Inch through 48 inch) for Welder.

.24 AWWA C151 - Ductile Iron Pipe, Centrifugally Cast, for Water.

.25 NFPA 13 - Installation of Sprinkler Systems.

.26 NFPA 13R - Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height.

.27 NFPA 25 – Standard for the Inspection, Testing and Maintenance of Water Based Fire Protection Systems

.28 UL - Fire Resistance Directory.

.29 UL 262 - Gate Valves for Fire-Protection Service.

.30 UL 312 - Check Valves for Fire-Protection Service.

.31 UL 405 - Fire Department Connections.

.32 Underwriters Laboratories of Canada (ULC)

.33 AWWA C220 – Stainless Steel Pipe 1/2In. (13 mm) and Larger.

.34 ASTM A312 – Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

.35 ASTM A779 – Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products

1.4 Submittals For Review

.1 Section: Procedures for submittals.

.2 Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

.3 Shop Drawings:

.1 Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

.2 Indicate hazard levels, and NFPA codes that are applicable to the system.

1.5 Submittals At Project Closeout

.1 Section: Procedures for submittals.

.2 Project Record Documents: Record actual locations of components and tag numbering.

.3 Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.6 Quality Assurance

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Carbon steel pipe and fittings manufactured in China or India will not be permitted.

.3 Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience, licensed in the Province of Manitoba,

member in good standing with the Canadian Automatic Sprinkler Association, and approved by manufacturer.

1.7 Regulatory Requirements

.1 Conform to cUL., UL., FM.

.2 Sprinkler Systems: Conform to NFPA 13.

.3 Welding Materials and Procedures: Conform to Manitoba Department of Labour and ASME Code requirements.

.4 Valves: Bear UL/cUL label or marking. Provide manufacturer's name and pressure rating marked on valve body.

.5 Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.8 Delivery, Storage, And Protection

.1 Section: Transport, handle, store, and protect products.

.2 Deliver and store valves in shipping containers, with labelling in place.

.3 Provide temporary protective coating on cast iron and steel valves.

.4 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.9 Extra Materials

.1 Section: Operation and Maintenance Data.

.2 Provide two of valve stem packings for each size and type of valve installed.

1.10 Design Calculations

.1 The contractor shall carry out all necessary calculations and shall submit all calculations, data, and drawings in conformance with the requirements of NFPA 13, and the local authority having jurisdiction for Contract Administrator’s review prior to proceeding with work. All design calculations are to be sealed by a Professional Engineer and shall be stamped reviewed by the authority having jurisdiction. Calculations shall be completed based on direction and restrictions given on drawings.

.2 The design shall be based on hazard occupancy as scheduled in Section 211300.

.3 The contractor shall be responsible to obtain water supply flow and pressure from the local municipal authority. If this information is not available, the contractor shall include all costs necessary for the testing.

1.11 Inspection And Tests

.1 All inspections and tests required by the above-mentioned authorities and agencies shall be arranged for and performed by this contractor.

.2 Inspections and testing to comply with NFPA 25.

.3 Carry out any necessary flow tests without extra compensation.

.4 All piping and fittings in the standpipe and sprinkler systems shall be hydrostatically tested at a pressure of 1380 kPa (200psi) for 2 hours without evidence of loss or leakage or as per NFPA 13 and/or 14.

Part 2 Products

2.1 Above Ground Piping And Fittings

.1 Steel Pipe: ASTM A53; ASTM A135; ASTM A135 UL listed, threadable, light wall; ASTM A795; or ASME B36.10; Schedule 10 black; or ASME B36.10; Schedule 40 black; or ASME B36.10; Schedule 10 galvanized; or ASME B36.10; Schedule 40 galvanized as scheduled below.

.1 Steel Fittings: ASME B16.9, wrought steel, buttwelded; ASME B16.25, buttweld ends; ASTM A234, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; ASME B16.11, forged steel socket welded and threaded.

.2 Cast Iron Fittings: ASME B16.1, flanges and flanged fittings; ASME B16.4, threaded fittings.

.3 Malleable Iron Fittings: ASME B16.3, threaded fittings ASTM A47.

.4 Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

.5 Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

2.2 Backflow Preventers

.1 Listed Double Check Valve Assemblies:

.1 Manufacturers:

.1 Beeco.

.2 Zurn.

.3 Watts.

.4 Substitutions: Refer to Section 21 05 00.

.2 ANSI/ASSE 1024 / CSA B64.4

2.3 Gate Valves

.1 Up to and including 50 mm (2 Inches):

.1 Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.

.2 Over 50 mm (2 Inches):

.1 Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged grooved ends.

.3 Over 100 mm (4 Inches):

.1 Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

2.4 Globe Or Angle Valves

.1 Up to and including 50 mm (2 Inches):

.1 Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackable under pressure.

.2 Over 50 mm (2 Inches):

.1 Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.5 Ball Valves

.1 Up to and including 50 mm (2 Inches):

.1 Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.

.2 Up to and including 50 mm (2 Inches):

.1 Stainless steel two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.

.3 Over 50 mm (2 Inches):

.1 Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle or gear drive handwheel for sizes 250 mm (10 inches) and over, flanged.

2.6 Butterfly Valves

.1 Bronze Body:

.1 Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and built-in tamper proof switch.

.2 Cast or Ductile Iron Body

.1 Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and tamper switch rated 10 amp at 115 volt AC.

2.7 Check Valves

.1 Up to and including 50 mm (2 Inches):

.1 Bronze body and swing disc, rubber seat, threaded ends.

.2 Over 50 mm (2 Inches):

.1 Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.

.3 100 mm (4 Inches) and Over:

.1 Iron body, bronze disc, stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

2.8 Drain Valves

.1 Compression Stop:

.1 Bronze with hose thread nipple and cap.

.2 Ball Valve:

.1 Brass with cap and chain, 20 mm (3/4 inch) hose thread unless otherwise noted.

2.9 Floor Plates

.1 In new construction, where pipes pass through concrete or masonry walls provide steel pipe sleeves full thickness of wall.

.2 In new construction, risers shall have watertight floor sleeves as recommended in NFPA 13. In renovation or existing construction, cored openings are acceptable provided the penetration is sealed and watertight, and meets all requirements of NFPA 13.

.3 Provide split or solid round floor plates on all exposed pipes passing through walls, floors, or ceilings.

2.10 Specialties

.1 Sight glass shall be a combination moisture and liquid indicator with protection cap. Sight glass shall be Alco, Mueller, Sporlan or Henry. Size shall be full line size.

.2 Pressure gauges shall comply with NFPA 13. Port connection shall not be smaller than 6.4mm. The pressure limit must not be less than twice the working pressure of the sprinkler/standpipe system.

.3 Signs

.1 Signs indicating valves shall be secured with metal wire or chains.

.2 Shall identify the portion of building served.

.3 Sign shall be made out of metal of rigid plastic

.4 As per NFPA 13

Part 3 Execution

3.1 Preparation

.1 Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

.2 Remove scale and foreign material, from inside and outside, before assembly.

.3 Prepare piping connections to equipment with flanges or unions.

3.2 Installation

.1 Use grooved mechanical couplings and fasteners only in accessible locations.

.2 Install piping to NFPA 13 for sprinkler systems as applicable.

.3 Plastic piping systems are not permitted.

.4 Pipe 38mm (1-1/2”) and smaller shall be joined by threaded connections.

.5 Pipe 50mm (2”) and larger may be joined by roll groove mechanical joints.

.6 Flexible sprinkler hoses acceptable where site conditions permit usage.

.7 All pipe installed so as to be inaccessible shall be joined by welded fittings. Piping in bulkheads or behind drywall shall be considered accessible. Piping in shaft walls or behind fire-rated drywall shall be considered inaccessible.

.8 Welded pipe sections shall be shop fabricated as far as possible to minimize field welding required.

.9 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by the same manufacturer.

.10 Side outlet mechanical tees that are comprised of gasketed cast iron housings that fully encircle the pipe and are secured with through-bolts are acceptable. Mechanical tees that use U-bolts or wire to secure the tee to the pipe will not be accepted.

.11 Route piping in orderly manner, plumb and parallel to building structure and as instructed on drawings. Maintain gradient.

.12 Install piping to conserve building space, to not interfere with use of space and other work.

.13 Group piping whenever practical at common elevations.

.14 In new construction, sleeve pipes passing through concrete or masonry partitions, walls, and floors.

.15 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

.16 Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

.17 Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

.18 Do not penetrate building structural members unless indicated.

.19 In new construction, provide sleeves when penetrating footings floors and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required. Sleeve locations shall be noted on shop drawings.

.20 When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

.21 Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

.22 Provide gate, ball or butterfly valves for shut-off or isolating service.

.23 Provide drain valves at main shut-off valves, low points of piping and apparatus. Obtain written approval from Contract Administrator for final locations of all drain valves not shown on drawings.

.24 All drains shall be routed to sanitary drainage points. Draining to the storm sewer system or sump pits is not allowed.

.25 Division 26 to wire monitoring alarm switches for each supervised valve. Alarms shall be connected to the annunciator panel. Coordinate wiring requirements with electrical trade.

.26 Final inspection and testing to conform to NFPA 25.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Dry-pipe sprinkler assembly.

.2 System design, installation, and certification.

1.2 Related Sections

.1 Section - Mechanical Identification.

.2 Section - Vibration Isolation.

.3 Section - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

.1 NFPA 13 - Installation of Sprinkler Systems.

.2 FM - Factory Mutual Approval Guide.

.3 NFPA 70 - National Electrical Code.

.4 UL - Fire Resistance Directory.

.5 UL 199 - Automatic Sprinklers for Fire-Protection Service.

.6 Underwriters Laboratories of Canada (ULC)

1.4 System Description

.1 System to provide coverage for building areas noted.

.2 Provide system to NFPA 13 requirements.

.3 Determine volume and pressure of incoming water supply from water flow test data.

.4 Interface system with building fire and smoke alarm system if applicable.

.5 Provide fire department connections where indicated.

1.5 Submittals For Review

.1 Section: Procedures for submittals.

.2 Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalogue information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

.3 Shop drawings:

.1 Submit working plans for sprinkler systems in accordance with requirements of NFPA 13, this specification, and the contract drawings. Plans shall include sprinkler locations coordinated with the architectural reflected ceiling plan and with the mechanical drawing set. All plans shall be sealed by a professional engineer prior to submission to the Contract Administrator for review, regardless of the size of the project.

.2 The contract drawings and specifications include project-specific requirements that may exceed the minimum requirements of the NFPA codes. These items shall be included in the fire protection contractor's work and shown on the working plans.

.3 Submit calculations in accordance with NFPA 13 requirements. Hydraulic calculations are required for all projects, subject to the following exception:

.1 Subject to the approval of the fire protection contractor's engineer of record, hydraulic calculations may be waived for renovation projects that affect 12 sprinkler or less, or with total renovated areas of140 m2 (1500ft2) or less, that are limited to relocation and/or conversion of sprinkler heads from upright to pendant (or vice versa), in which hazard classification(s) has not changed.

.2 Should the fire protection contractor's engineer of record be satisfied that design conditions have not changed enough to warrant updated hydraulic calculations, submit a letter under seal stating as such along with the rationale for the assessment. Alternatively, include a note on the sealed working drawings indicating same as above.

.4 Submit to authority having jurisdiction for review and approval prior to submission to Contract Administrator. Submit proof of approval to Contract Administrator.

1.6 Submittals At Project Closeout

.1 Section: Procedures for submittals.

.2 Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

.3 Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

.4 Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

.5 Warranty: Submit manufacturer warranty and ensure forms have been completed in The City's name and registered with manufacturer.

1.7 Quality Assurance

.1 Perform Work to NFPA 13.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.3 Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

.4 Design system under direct supervision of a Professional Engineer experienced in design of this Work and licensed at the place where the Project is located.

1.8 Regulatory Requirements

.1 Conform to ULC and FM.

.2 Perform Work to NFPA 13.

.3 Equipment and Components: Bear ULC, UL, FM label or marking.

.4 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.9 Delivery, Storage, And Protection

.1 Section: Transport, handle, store, and protect products.

.2 Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.10 Extra Materials

.1 Section: Operation and maintenance data.

.2 Provide extra sprinklers to NFPA 13.

.3 Provide suitable wrenches for each sprinkler type.

.4 Provide metal storage cabinet located adjacent to alarm valve.

Part 2 Products

2.1 SPRINKLERS

.1 Dry Sprinklers:

.1 Type: Standard Exposed pendant type with matching push on escutcheon plate.

.2 Finish: Chrome plated.

.3 Escutcheon Plate Finish: To match sprinkler body.

.4 Fusible Link: Glass bulb type temperature rated for specific area hazard unless otherwise noted.

.2 Guards: Finish to match sprinkler finish.

2.2 Piping Specialties

.1 Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with accelerator; with test and drain valve.

.2 Pressure Gauge: Provide ULC FM approved listed for fire protection, having aluminum cases, bronze geared movements, bronze bourdon type, friction glass cover and precision type pointer. Accuracy to be 1% of full span. Gauges shall be 100mm diam. throughout. Pressure range shall be selected so that needle is approximately vertical at normal system pressure. Gauges shall have dual scale (psi/kPa) with psi more prominent.

.3 Pressure Reducing Valves: Provide, where required, ULC and FM labelled pressure reducing valves (PRV) with adjustable spring range, sized to suit required flow and pressure differential, capable of maintaining differential pressure at 138 kPa (20 psi) during both flow and static conditions. Provide all necessary trim: Downstream and upstream pressure gauges, isolation valves, by-pass valves, pressure relief valve on low pressure side to compensate for leakage across the PRV.

.4 Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

2.3 Air Compressor

.1 Connect new dry sprinkler zone in crawlspace to existing air compressor system in main building.

Part 3 Execution

3.1 Installation

.1 Install to NFPA 13.

.2 Install equipment to manufacturers written instructions.

.3 Install buried shut-off valves in valve box. Provide post indicator.

.4 Provide approved double backflow preventer assembly at sprinkler system water source connection as required by authority having jurisdiction.

.5 Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent fire department connectors to allow full swing of fire department wrench handle.

.6 Coordinate location of outside alarm gong on building wall with fire alarm contractor.

.7 Place pipe runs to minimize obstruction to other work.

.8 Place piping in concealed spaces above finished ceilings.

.9 Centre sprinklers in one direction only in ceiling tile with location in other direction at ¼, ½, or ¾ of the ceiling tile length, dependent upon spacing and coordination with ceiling elements. Layout instructions provided on the architectural and mechanical drawings override spacing instruction given above.

.10 Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. The contractor shall bear all responsibility to clean sprinklers of paint or if necessary to replace with new.

.11 Install air compressor on vibration isolators. Refer to Section 23 05 48.

.12 Flush entire piping system of foreign matter.

.13 Install guards on sprinklers where indicated and as per NFPA 13.

.14 Hydrostatically test entire system. Test shall be witnessed by authority having jurisdiction.

.15 System drains and test connections: run to the nearest open drain in the building or to outdoors through wall away from paved areas. Seal and caulk around piping through wall and provide escutcheon and prime paint all metal surfaces exposed to outdoors.

.16 Before commencement of any work, examine work of other trades and make immediate report to Contract Administrators of any defect or interference affecting work or guarantee of this work.

.17 If drilling of structural beams or other load bearing members is required by design or by site conditions for passage of piping, obtain Contract Administrators approval for location and proposed drilling procedure before drilling. Drill only in locations previously approved by Contract Administrator. Where drilling is required by design or existing site conditions, be responsible for carrying out same to approved procedure.

.18 Allow for expansion and contraction when installing pipe hangers.

.19 Install horizontal valves with stems upright where space allows.

.20 Carefully coordinate work with other trades so that unnecessary offsets and revisions to the approved drawings are avoided. Failure to coordinate does not relieve Contractor from meeting performance standards.

.21 The Project Coordinator shall approve any shutdowns of existing water distribution systems, fire sprinkler systems, domestic water systems or fire alarm systems. Provide advance written notice at least 14 days prior to the shutdown to the Construction Coordinator.

.22 Application specific sprinklers such as window sprinklers shall be installed in accordance with the listing requirements.

.23 Provide deflectors between sprinkler heads where minimum separation distances between heads does not conform to NFPA 13 or manufacturer's requirements.

3.2 Interface With Other Products

.1 Ensure required devices are installed and connected as required to fire alarm system.

3.3 Schedules

.1 Refer to the drawings for sprinkler schedules.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Pipe, pipe fittings, valves, and connections for piping systems.

.1 Sanitary sewer.
.2 Domestic water.
.3 Storm water.

1.2 Related Sections

.1 Section 09 09 00 – Painting.

.2 Section 23 05 48 - Vibration Isolation.

.3 Section 23 05 53 - Mechanical Identification.

.4 Section 23 07 19 - Piping Insulation.

.5 Section 23 05 16 – Piping Expansion Compensation.

.6 Section 23 05 29 – Supports and Anchors.

.7 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

.8 Section 31 22 13 - Excavation and Fill.

1.3 References

.1 ASTM E814 - Fire Tests of Through-Penetration Fire Stops.

.2 UL 1479 - Fire Tests of Through-Penetration Firestops.

.3 CAN/ULC-S102.2 - Standard method of test for surface burning characteristics of flooring, floor covering and miscellaneous materials and assemblies

.4 CAN/CSA-B1800 - Thermoplastic non-pressure piping

.5 NSF/ANSI 14 - Plastics Piping System Components and Related Materials

.6 ASME B31.9 - Building Services Piping.

.7 ASME SEC IX - Welding and Brazing Qualifications.

.8 ASME B16.3 - Malleable Iron Threaded Fittings.

.9 MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

.10 MSS SP69 - Pipe Hangers and Supports - Selection and Application.

.11 MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.

.12 MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

.13 MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

.14 NCPWB - Procedure Specifications for Pipe Welding.

.15 ASTM F708 - Design and Installation of Rigid Pipe Hangers.

.16 ASME B16.4 - Grey Iron Threaded Fittings.

.17 ANSI/AWWA C651 - Disinfecting Water Mains.

.1 AWS A5.8 - Filler Metals for Brazing and Braze Welding.

.2 ASME B16.22-2001 (R2005) - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.3 ASME B16.26 - Copper Alloy Bronze Fittings for Flared Copper Tubes.

.4 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

.5 ASTM B42 - Seamless Copper Pipe, Standard Sizes.

.6 ASTM B43 - Seamless Red Brass Pipe, Standard Sizes.

.7 ASTM B68 - Seamless Copper Tube, Bright Annealed.

.8 ASTM B75 - Seamless Copper Tube.

.9 ASTM B22.18-03 - Seamless Copper Water Tube.

.10 ASTM B251 - General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.

.11 ASTM B302 - Threadless Copper Pipe, Standard Sizes.

.12 ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

.13 ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.

.14 ASME B16.32 - Cast Copper Alloy Solder Joint Fittings for Solvent Drainage Systems.

.15 ASTM A74 - Cast Iron Soil Pipe and Fittings.

.16 ASTM B306 - Copper Drainage Tube (DWV).

.17 ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

.18 ASTM B32-04 - Solder Metal.

.19 CISPI 301 - Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.

.20 CISPI 310 - Joints with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

.21 MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.

.22 MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends.

.23 MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.

.24 MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends.

.25 ASTM D2665 - Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

.26 ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

.27 ASTM D2855-96 (2002) - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

.28 ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.29 ASTM D2241 - Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

.30 ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.31 ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

.32 AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inch - 48 inch (350 mm - 1200mm).

.33 ASTM C1053 - Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.

.1 CAN/CSA-B1800 - Thermoplastic non-pressure piping

.2 NSF/ANSI 14 - Plastics Piping System Components and Related Materials

.3 ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials

.4 ASTM F1412. - Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems

.5 ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

.6 ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

.7 ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

.8 ASTM F437 - Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

.9 ASTM F438 - Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.

.10 ASTM F439 - Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

.11 ASTM F441 - Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

.12 ASTM F442 - Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe k(SDR-PR).

.13 ASTM F493 - Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

.14 ASTM F679 - Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

.15 CAN/CSA B137.6 - Chlorinated Polyvinylchloride (CPVC) Pipe, Tubing, and Fittings for Hot-and Cold-Water Distribution Systems

.16 CAN/CSA-B1800-15 - Thermoplastic non-pressure piping.

.17 ASTM A47/A47M - Ferritic Malleable Iron Castings.

.18 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.19 ASTM A234/A234M - Piping Fittings of Wrought-Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

.20 AWWA C105 - Polyethylene Encasement for Ductile-Iron Piping Systems.

.21 AWWA C220 – Stainless Steel Pipe 1/2In. (13 mm) and Larger.

.22 ASTM A312 – Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

.23 ASTM A779 – Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products

1.4 Submittals For Review

.1 Section 21 05 00: Submission procedures.

.2 Product Data: Provide data on all valves larger than 50mm (2”), and all backflow prevention devices and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

1.5 Closeout Submittals

.1 Section 21 05 00: Submission procedures.

.2 Record Documentation: Record actual locations of valves on record drawings.

1.6 Quality Assurance

.1 Perform Work to the standards of the Province and Municipality of Jurisdiction.

.2 Valves: Manufacturer's name and pressure rating marked on valve body.

.3 Welding Materials and Procedures: Conform to ASME SEC IX and applicable Provincial labour regulations.

.4 Welder's Certification: To Manitoba Department of Labour standards.

.5 Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

.6 Carbon steel pipe and fittings manufactured in China or India will not be permitted.

1.7 Regulatory Requirements

.1 Perform Work to the latest version of the Manitoba Plumbing Code and local Municipal requirements

.2 Conform to applicable code for installation of backflow prevention devices.

.3 Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.8 Delivery, Storage, And Protection

.1 Refer to specification section Product Requirements: Transport, handle, store, and protect products.

.2 Accept valves on site in shipping containers with labelling in place. Inspect for damage.

.3 Provide temporary protective coating on cast iron and steel valves.

.4 Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

.5 Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.9 Environmental Requirements

.1 Refer to specification section Environmental Protection: Environmental conditions affecting products on site.

.2 Do not install underground piping when bedding is wet or frozen.

Part 2 Products

2.1 Sanitary Sewer Piping, Buried Within 1500 Mm (5 Feet) Of Building

.1 PVC Pipe: CAN/CSA B1800

.1 Fittings: PVC.

.2 Joints: ASTM D2855, solvent weld to ASTM D2564.

2.2 Sanitary Sewer Piping, Above Grade

.1 PVC Pipe with FSR25: CAN/CSA B1800

.1 Fittings: PVC.

.2 Joints: ASTM D2855, solvent weld to ASTM D2564.

2.3 Sump Pump Discharge Piping

.1 PVC Pipe: CAN/CSA B1800

.1 Fittings: PVC.

.2 Joints: ASTM D2855, solvent weld to ASTM D2564.

2.4 Storm Water Piping, Buried Within 1500 Mm (5 Feet) Of Building

.1 PVC Pipe: SDR 35; CAN/CSA B1800.

.1 Fittings: PVC.

.2 Joints: ASTM F477, elastomeric gaskets.

2.5 Storm Water Piping, Above Grade

.1 PVC Pipe: CAN/CSA B1800

.1 Fittings: PVC.

.2 Joints: ASTM D2855, solvent weld to ASTM D2564.

2.6 SWING CHECK VALVES

.1 Construction: Up to and including 80 mm (3 inches):

.1 Manufacturers:

.1 Kitz.

.2 Substitutions: Refer to Section 21 05 00.

.2 MSS SP-80, Class 150, bronze body and cap, bronze swing disc with rubber seat, solder ends. CSA B62 compliant.

.2 Construction: 50 mm (2 inches) and Larger:

.1 Manufacturers:

.1 American Valve, Inc.

.2 Kitz Corporation.

.3 Watts Regulator ;

.4 Zy-Tech Global Industries, Inc.

.5 Substitutions: Refer to Section 21 05 00.

.2 MSS SP-71, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged ends. CSA B62 compliant.

.3 Construction: PVC:

.1 CSA B62, ASTM D1784

.1 NSF 61 compliant for potable water applications.

.2 Manufacturers:

.1 IPEX

.2 Substitutions: Refer to Section 21 05 00.

.3 Material: Valve body, bonnet, swing arm, and disc of PVC to ASTM D1784.

.4 Seals: O-ring seals and shutter of EPDM.

.5 Connections: socket weld with union connection

.6 Swing check valves shall be full flow, gravity operated, full face disc seal, full open disc stop to prevent over-travel, no wetted metal parts.

.7 Service of the valve shall be possible without removal from the system line.

.8 Installable in either horizontal or vertical orientations.

.9 Valve ratings:

.1 Up to 75 mm (3") shall be rated at 100 psi at 73°F.

.2 +100 mm (+4") shall be rated at 70 psi at 73°F.

2.7 Spring Loaded Check Valves

.1 Manufacturers:

.1 Class 150: Mueller 72-IHB-3-H (Ductile Iron Body) Moygro &-I515WM5B (SS Disc, Viton Seat)

.2 Substitutions: Refer to Section 21 05 00.

.2 Class 150, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

.3 Construction: PVC:

.1 CSA B62, ASTM D1784

.1 NSF 61 compliant for potable water applications.

.4 Manufacturers:

.1 IPEX

.2 Substitutions: Refer to Section 21 05 00.

.5 Material: Valve body, ball, end connectors and unions of PVC to ASTM D1784.

.6 Seals: O-ring seals and shutter of EPDM.

.7 Spring Material: Stainless steel

.8 Connections: socket weld, union end connection.

.9 Installable in either horizontal or vertical orientations.

.10 Valve ratings: 1600 kPa (232 psi) at 23°C (73°F).

2.8 Fire Stop Systems

.1 As per Section 07 84 00 – Firestopping.

Part 3 Execution

3.1 Examination

.1 Section 21 05 00: Verify existing conditions before starting work.

.2 Verify that excavations are to required grade, dry, and not over-excavated.

3.2 Preparation

.1 Ream pipe and tube ends. Remove burrs.

.2 Remove scale and dirt, on inside and outside, before assembly.

.3 Prepare piping connections to equipment with flanges or unions.

3.3 Installation

.1 Install to manufacturer's written instructions.

.2 Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

.3 Install piping to maintain headroom, conserve space, and not interfere with use of space.

.4 Group piping whenever practical at common elevations.

.5 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.

.6 Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 19.

.7 Establish elevations of buried piping outside the building to ensure not less than 2.4 m (8 ft) of cover.

.8 Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

.9 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

.10 Provide support for utility meters to requirements of utility companies.

.11 Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to 09 90 00 – Painting.

.12 Support for buried pipe under concrete structural slabs shall be hung from the slab using epoxy coated or stainless steel hangers, hardware and hanger rod secured to the rebar.

.13 Excavate to Sections 31 22 13 for work of this Section.

.14 Backfill to Sections 31 22 13 for work of this Section.

.15 Sleeve pipes passing through partitions, walls and floors. Set sleeves in concrete forms for all pipes passing through concrete walls, beams and slabs.

.16 Install 100 mm (4 inch) concrete curbs around all pipe penetrations in mechanical rooms.

.17 Pipe sleeves to extend above floor line as follows:

- .1 Unfinished areas – 25 mm (1 inches).
- .2 Finished areas (copper sleeves) – 7 mm (1/4 inches).
- .3 Mechanical rooms, kitchens and washrooms – 100 mm (4 inches).

.18 Caulk sleeves to provide watertight installation.

.19 Where pipes pass through floors and walls in finished areas and where exposed to view, provide Crane #10 B.C. chrome-plated, pressed steel floor plates.

.20 Install galvanized, oversize pipe sleeves on passing through walls or partitions, for building into wall construction, by other trades.

.21 Sleeves and holes for piping on cold water systems shall be large enough to accommodate pipe insulation. Insulation on piping for hot water systems may stop at walls or floors.

.22 Prior to installing sleeves in concrete beams, receive final jobsite approval by Structural Contract Administrator.

.23 Storm water piping: Install clamps across all no-hub MJ couplings on piping 125 mm (5") and larger for all horizontal piping, including elbows at the base of vertical pipes. Refer to 23 05 29 for supports and anchors on storm water piping.

3.4 Pipe Pressure Testing

.1 Do not insulate pipe prior to pressure testing. Pressure test in sections if necessary before concealing or insulating pipe.

.2 Do not introduce water for testing where freezing conditions exist or where piping systems being tested are located above sensitive areas or equipment that may be damaged or contaminated by water leakage.

.3 Hydraulically test all pipe. Pneumatic testing not permitted without prior approval from the Contract Administrator and the Authority Having Jurisdiction.

.4 Should leaks develop in any part of the piping system, remove and replace defective sections, fittings and equipment. Pipe dope, caulking, tape, lead wool, dresser couplings, etc. shall not be used to correct deficiencies. The contractor shall be responsible for all cleanup related to leakage during flushing, testing, and chemical treatment of piping, including original building piping if included in the testing.

.5 Subject piping to a hydrostatic pressure of at least that 1-½ times the operating pressure of the system for a period of at least 12 hours. If leaks are detected, such leaks shall be repaired and the test started over. Record results and submit witnessed (by consultant or The City's representative) reports to the Contract Administrator.

.6 Cast iron piping systems: water-test each portion of the system for 15 minutes at a head pressure of 10' of water. Test procedure shall be in accordance with CISPI and the manufacturer's recommendations. Compressed air shall not be used for testing.

.7 Register pressures at the highest system point.

.8 Provide at least 48 hours (during working days) notice to Contract Administrator or The City's Representative prior to testing to allow the tests to be witnessed.

3.5 APPLICATION

.1 Provide spring loaded check valves on discharge of water pumps.

.2 PVC DWV piping installed in non-combustible buildings shall comply with the restrictions in the following table.

COMBUSTIBLE PIPE APPLICATIONS SUITABILITY FOR USE					
Product	NON-COMBUSTIBLE BUILDING				
	General Usage	Air Plenum1	Vertical Services Spaces2	High-Rise Building	Underground
Combustible Pipe FSR25: (eg. IPEX System 15)	P	N3	N	N	P
Combustible Pipe FSR25/SDC50: (eg. IPEX XFR, CPVC)	P	P	N	P	P
MJ Grey Coupling	P	P	N	P	N

1. Restrictions for air plenums also apply to combustible buildings as well.
2. Certified firestopping devices are required whenever the system penetrates a vertical or horizontal separation, and shall be certified to CAN4-S115 and tested with a pressure differential of 50 Pa.
3. Sizes 20” and 24” are N

3.6 Erection Tolerances

.1 Establish invert elevations, slopes for drainage to one percent (1/8 inch per foot) minimum, except pipe sized 75 mm (3 inches) or less shall have a slope no less than two percent (1/4 inch per foot). Maintain gradients.

.2 Slope water piping minimum 0.25 percent and arrange to drain at low points.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Cleanouts.

.2 Backwater valves

.3 Polyethylene Sump Pit

1.2 Related Sections

.1 D1 - Summary of Work: Product requirements for The City Provided equipment.

.2 Section 22 10 00 - Plumbing Piping.

.3 Section 22 47 00 - Plumbing Equipment.

.4 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

- .1 ASME - SEC 8D - Boilers and Pressure Vessels Code - Rules for Construction of Pressure Vessels.
- .2 ASME A112.6.3 - Floor and Trench Drains
- .3 ASME A112.6.4 – Roof, Deck and Balcony Drains
- .4 ASME A112.26.1 - Water Hammer Arrestors.

.2 American Society of Sanitary Engineers (ASSE)

- .1 ASSE 1010 - Performance Requirements for Water Hammer Arresters
- .2 ASSE 1011 - Hose Connection Vacuum Breakers.
- .3 ASSE 1012 - Backflow Preventers with Immediate Atmospheric Vent.
- .4 ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.
- .5 ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.

.3 American Society for Testing and Materials (ASTM)

- .1 ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- .2 ASTM D2855 - Standard Practice for the Two-Step Method of Joining PVC or CPVC Pipe and Piping Components with Tapered Sockets

.4 American Water Works Association (AWWA)

- .1 AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.

.5 Canadian Standards Association

- .1 CSA B70 – Cast Iron Soil Pipe, Fittings, and Means of Joining
- .2 CSA B125.1/ASME A112.18.1 - Plumbing Supply Fittings
- .3 CAN/CSA-B181.1 - Acrylonitrile-Butadiene-Styrene(ABS) Drain, Waste, and Vent Pipe and Pipe Fittings

.4 CAN/CSA-B181.2 - Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings

.5 CAN/CSA-B182.1 – Plastic Drain and Sewer Pipe and Pipe Fittings

.6 CSA B79 - Commercial and Residential Drains and Cleanouts.

.7 CAN/CSA B356 - Water Pressure Reducing Valves for Domestic Water Supply Systems.

.6 National Safety Foundation (NSF)

.1 NSF/ANSI 61 – Drinking Water System Components – Health Effects

.7 PDI G-101 - Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.

.8 CSA-B64-2011 Series - Backflow Preventers and Vacuum Breakers.

.1 CSA B64.1.1/ANSI/ASSE 1001– Performance requirements for Atmospheric Type Vacuum Breakers (AVB)

.2 CSA B64.4 - Reduced pressure principle (RP) backflow preventers

.3 CSA B64.10 - Selection and installation of backflow preventers/Maintenance and field testing of backflow preventers

.9 CSA B125.3 – Plumbing Fittings

1.4 Submittals For Review

.1 Section 21 05 00: Submission procedures.

.2 Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

.3 Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

1.5 Closeout Submittals

.1 Section 21 05 00: Submission procedures.

.2 Operation Data: Indicate frequency of treatment required for interceptors.

.3 Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

.4 Record Documentation: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors, trap seal primers.

1.6 Maintenance Material Submittals

.1 Section 01 78 00: Maintenance and extra material requirements.

.2 Extra Stock Materials: Supply two (2) loose keys for outside hose bibs.

1.7 Quality Assurance

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.8 Regulatory Requirements

.1 Perform Work to the latest version of the Manitoba Plumbing Code and local Municipal requirements.

.2 All components installed in domestic water system to be lead free.

1.9 Delivery, Storage, And Protection

.1 Section 21 05 00: Transport, handle, store, and protect products.

.2 Accept specialties on site in original factory packaging. Inspect for damage.

Part 2 Products

2.1 Cleanout Covers

.1 Exterior Surfaced Areas:

.1 Manufacturers:

.1 Mifab

.2 Zurn.

.3 Watts.

.4 Substitutions: Refer to Section 21 05 00.

.2 Round cast nickel bronze access frame and non-skid cover.

.2 Exterior Unsurfaced Areas:

.1 Line type with lacquered cast iron body and round epoxy coated gasketed cover.

.3 Interior Finished Floor Areas:

.1 Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

.4 Interior Finished Wall Areas:

.1 Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

.5 Interior Unfinished Accessible Areas:

.1 Caulked or threaded type.

.2 Bolted stack cleanouts on vertical rainwater leaders.

2.2 Backwater Valves

.1 Cast Iron:

.1 Manufacturers:

.1 Mifab

.2 Zurn.

.3 Watts.

.4 Substitutions: Refer to Section 21 05 00.

.2 CSA B70; lacquered cast iron body and cover, brass valve, 150 mm (6 inch) extension sleeve, and access cover.

.2 PVC

.1 Manufacturers:

.1 IPEX

.2 Canplus

.3 Substitutions: Refer to Section 21 05 00.

.2 CAN/CSA-B181.2, Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste Vent Pipe and Pipe Fittings

.3 Size to match drain pipe, extension sleeve, and access cover.

2.3 Polyethylene Sump Pits

.1 Manufacturer: Polywest Model SP-02OCT Sump Pit

.2 Other acceptable manufacturers offering equivalent products.

.1 Substitutions: Refer to Section 21 05 00.

.3 Construction:

.1 Unit shall be constructed

.2 Minimum Dimensions:

.1 Diameter: 30” (750mm)

.2 Depth: 30” (750mm)

.3 Outlet/Inlets:

.1 Cut to suit on site.

.2 Refer to architectural drawings for scope.

.4 Basin Extension

.1 Diameter shall be minimum 18”

.2 Depth shall be 12”

.3 Provide quantity necessary to suit site condition.

Part 3 Execution

3.1 Installation

.1 Install to manufacturer instructions.

.2 Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

.3 Install wall cleanouts serving urinals above the flood plane of the fixture but below the top of the fixture it serves not including the flush valve.

.4 Encase exterior cleanouts in concrete flush with grade.

.5 Install floor cleanouts at elevation to accommodate finished floor.

.6 Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Pumps.

.1 Sump Pumps.

1.2 Related Sections

.1 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 Submittals For Review

.1 Section 21 05 00: Submission procedures.

.2 Product Data:

.1 Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.

.2 Indicate pump type, capacity, power requirements.

.3 Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

.4 Provide electrical characteristics and connection requirements.

.3 Shop Drawings:

.1 Indicate heat exchanger dimensions, size of tappings, and performance data.

.2 Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

1.4 Closeout Submittals

.1 Section 21 05 00: Submission procedures.

.2 Record Documentation: Record actual locations of components and electrical power supply.

.3 Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

.4 Test Results: Provide water hardness results for pre- and post-softened water.

.5 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in The City's name and registered with manufacturer.

1.5 Quality Assurance

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years experience.

.2 Provide pumps with manufacturer's name, model number, and rating/capacity identified.

.3 Ensure products and installation of specified products are to recommendations and requirements of the following organizations:

.1 American Gas Association (AGA).
.2 National Sanitation Foundation (NSF).
.3 American Society of Mechanical Engineers (ASME).
.4 National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
.5 National Electrical Manufacturers' Association (NEMA).
.6 Underwriters Laboratories (UL).

.4 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.6 Regulatory Requirements

.1 Conform to CGA / AGS requirements for water heaters.

.2 Conform to ASME Section 8D for manufacture of pressure vessels for heat exchangers.

.3 Conform to ASME Section 8D for tanks.

.4 Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.7 Delivery, Storage, And Protection

.1 Section 21 05 00: Transport, handle, store, and protect products.

.2 Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 Warranty

.1 Section 21 05 00: Warranties.

.2 Provide a five (5) year warranty to include coverage for failure to meet specified requirements, for domestic water heaters, water storage tanks, and packaged water heating systems.

Part 2 Products

2.1 Submersible Sump Pumps

.1 Manufacturers:

.1 Little Giant ESP33 Series.
.2 Liberty
.3 ITT / Goulds.
.4 Barnes.
.5 Substitutions: Refer to Section 21 05 00.

.2 Type: Completely submersible, vertical, centrifugal.

.3 Motor: thermal overload protected, stainless-steel heat-treated shaft, continuous duty oil-free motor, permanently lubricated lip seal.

.4 Casing: Cast iron pump body.

.5 Impeller: Glass-reinforced thermoplastic, stainless-steel heat-treated shaft.

.6 Solids handling capability: 1/2".

.7 Bearings: Ball bearings.

.8 Accessories: Oil resistant 3 m (10 foot) cord and plug with three-prong connector for connection to electric wiring system.

.9 Controls:

.1 AE Sries Duplex Pump Controls – (Liberty Pumps)
.2 NEMA 4X ultraviolet stabilized thermoplastic enclosure
.3 HOA switch allows for "Hand" (manual) "Off" or "Automatic" operation
.4 Control/Alarm ON/OFF switch
.5 Entire unit UL listed and tested by UL to CSA standards
.6 Two sensor floats and an alarm float
.7 Float switch status indicators
.8 83-85db audible alarm buzzer
.9 Auxiliary contacts for connection to DDC

.10 Provide additional remote audible and visual alarm devices for location in occupied space to annunciate sump high level alarm.

.11 Performance:

.1 Refer to schedules.

Part 3 Execution

3.1 Installation

.1 Coordinate with plumbing piping and related fuel piping, gas venting, and electrical work to achieve operating system.

.2 Pumps:

.1 Ensure shaft length allows sump pumps to be located minimum 600 mm (24 inches) below lowest invert into sump pit and minimum (150 mm 6 inches) clearance from bottom of sump pit.
.2 Provide air cock and drain connection on horizontal pump casings.
.3 Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
.4 Decrease from line size with long radius reducing elbows or reducers.
.5 Support piping adjacent to pump such that no weight is carried on pump casings.
.6 Provide supports under elbows on pump suction and discharge line sizes 100 mm (4 inches) and over.
.7 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
.8 Align and verify alignment of base mounted pumps prior to start-up.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Pipe and equipment hangers and supports.

.2 Equipment bases and supports.

.3 Sleeves and seals.

.4 Flashing and sealing equipment and pipe stacks.

1.2 Related Sections

.1 Section 03 30 00 - Cast-in-place Concrete: Equipment bases.

.2 Section 09 90 00 - Painting.

.3 Section 21 11 00 - Fire Protection Piping.

.4 Section 23 07 19 - Piping Insulation.

.5 Section 23 07 16 - Equipment Insulation.

.6 Section 22 10 00 - Plumbing Piping.

1.3 References

.1 ASME B31.9 - Building Services Piping.

.2 ASTM F708 - Design and Installation of Rigid Pipe Hangers.

.3 CSA 149.1 - Natural gas and propane installation code

.4 MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

.5 MSS SP69 - Pipe Hangers and Supports - Selection and Application.

.6 MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

.7 NFPA 13 - Installation of Sprinkler Systems.

.8 UL 203 - Pipe Hanger Equipment for Fire protection Service.

1.4 Submittals

.1 Section 21 05 00: Procedures for submittals.

.2 Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

.3 Product Data: Provide manufacturers catalogue data including load capacity.

.4 Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

.5 Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.5 Regulatory Requirements

.1 Conform to applicable code for support of plumbing, and hydronic piping.

.2 Supports for Sprinkler Piping: To NFPA 13.

.3 Supports for Standpipes: To NFPA 14.

Part 2 Products

2.1 PIPE HANGERS AND SUPPORTS

.1 Manufacturers:

.1 Anvil.
.2 Grinnel.
.3 Substitutions: Refer to Section 21 05 00.

.2 Fire Protection Piping:

.1 Conform to NFPA 13.
.2 Hangers for Pipe Sizes 13 to 38 mm (1/2 to 1-1/2 inch): Stainless steel, adjustable swivel, split ring.
.3 Hangers for Pipe Sizes 50 mm (2 inches) and over: Stainless steel, adjustable, clevis.

.3 Plumbing Piping - DWV:

.1 Conform to ASME B31.9.
.2 PVC DWV Pipe Support: to manufacturer’s requirements.
.1 All pipe hangers shall be stainless steel for corrosion resistance

2.2 Accessories

.1 Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

2.3 Inserts

.1 Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 Sleeves

.1 Sleeves for Pipes Through Non-fire Rated Floors: 1.2 mm thick (18 gauge) galvanized steel.

.2 Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 1.2mm thick (18 gauge) galvanized steel.

.3 Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

.4 Where pipes pass through floors, walls or ceilings, in finished areas and where exposed to view, supply and install chrome-plated pressed steel floor plates.

.5 Sleeves for Round Ductwork: Galvanized steel.

.6 Sleeves for Rectangular Ductwork: Galvanized steel or wood.

.7 Firestopping Insulation: Glass fibre type, non-combustible.

Part 3 Execution

3.1 Installation

.1 Install to manufacturer's written instructions.

3.2 Inserts

.1 Provide inserts for placement in concrete formwork.

.2 Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

.3 Provide hooked rod to concrete reinforcement section for inserts carrying pipe over100 mm (4 inches).

.4 Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

.5 Install galvanized oversize pipe sleeves on all pipes passing through walls or partitions, for building into wall construction by other trades.

.6 All sleeves are to be large enough to accommodate pipe insulation as specified.

.7 The Mechanical Division shall include in tender price all cost of drilling for sleeves up to 175 mm (7") in precast sections relative to work under Mechanical Division. Prior to drilling all openings/locations must be checked by the Contract Administrator. Drilling shall be done using diamond core drilling machinery.

.8 Caulk the space between pipes and floor sleeves or openings, to prevent water seeping down, with an approved caulking compound. The caulking compound and method of application shall be to the Contract Administrator's approval.

.9 Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

3.3 Pipe Hangers And Supports

.1 Install to manufacturer's written instructions.

.2 Perforated strap or wire hangers will not be permitted.

.3 Support horizontal piping as scheduled.

.4 Support for buried pipe under a new slabs or existing shall be hung from the slab using epoxy coated or stainless steel hangers, hardware and hanger rod secured to the rebar.

.5 Hangers in new concrete structural floor systems shall be supported by inserts placed prior to pouring of concrete. Inserts shall be Grinnell cast iron or wrought steel adjustable type.

.6 Where hangers must be installed in existing concrete slabs, approved expansion type inserts shall be used, or if heavy weights must be supported, a hole shall be drilled through the slab and a 50 mm x 50 mm (2" x 2") washer and nut installed above rough slab before the floor finish is poured.

.7 Where the structural system is open web steel joists, piping shall be supported by means of angles spanning the top chords of adjacent joists. The number of joists to be spanned in this way shall be determined by the incident load of piping.

.8 In no case shall the hanging of piping directly from roof or ceiling decking be allowed, unless special permission is obtained from the Contract Administrator.

.9 Copper hot water piping in long runs, where expansion may be significant and where hanger rods are less than 600 mm (2") in length may require roller hangers. Any such cases which cannot be avoided shall be referred to the Contract Administrator for a decision. If necessary, roller hangers shall be installed as directed with protection saddles as specified. Expansion and contractions of domestic H.W. piping should not be a problem, as wide fluctuations in temperature are not normal. Piping shall be hung from slabs, rather than from the bottom of beams, in order to keep hanger rods sufficiently long to take up any movement.

.10 Install hangers to provide minimum 13 mm (1/2 inch) space between finished covering and adjacent work.

.11 Place hangers within 300 mm (12 inches) of each horizontal elbow.

.12 Use hangers with 38 mm (1-1/2 inch) minimum vertical adjustment.

.13 Support horizontal cast iron pipe adjacent to each hub, with 1.5 m (5 feet) maximum spacing between hangers.

.14 Where pipes are joined with MJ couplings support on both sides of the joint. At multiple fittings or short lengths, support every 300 mm (12”).

.15 Storm water piping:

- .1 All pipe supports, anchors, clamping, and thrust supports shall support the weight of the pipe and its contents.
- .2 Provide all necessary support to restrain thrust forces resulting from internal pipe pressures. Refer to CISPI 301 & 310.
- .3 MJ couplings are not permitted on PVC storm water piping. All joints to be solvent-welded.
- .4 For cast-iron systems, install restraint clamps across all no-hub MJ couplings on piping 125 mm (5”) and larger for all horizontal piping, including elbows at the base of a vertical pipe. Clamps shall be socket clamps on either side of the coupling connected with suitably sized threaded rod.
- .5 Restrain all joints on piping 125 mm (5”) and larger to prevent horizontal movement. Use sway bracing as needed to restrain sideways movement of the system. Install blocks, rods, bracing or other suitable methods at each branch opening or change in direction.

.6 Storm water piping below grade including in the crawlspace shall be adequately supported with thrust blocks or suitable anchors to restrain all sideways movement and thrust forces.

.16 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.17 Support riser piping independently of connected horizontal piping.

.18 Design hangers for pipe movement without disengagement of supported pipe.

.19 All hanger rods shall have sufficient threaded length to allow for vertical adjustment of hangers after pipe is in place. Use 2 nuts on each rod, one above the clevis or angle iron and one below.

.20 Where pipes or equipment are supported from floors or walls, structural steel supports shall be fabricated, using welded joints except where provision is made for adjustment. Where details of construction are not indicated, drawings shall be submitted to Contract Administrator for approval before fabrication.

.21 Clamps should be located immediately below a coupling if possible. Risers up to 50 mm (2") size shall be braced at intervals not over 2100 mm (7').

.22 Vertical piping other than risers through floors shall be provided with suitable supports, sway braces, etc.

.23 Vertical piping shall be supported at the base in an approved manner.

.24 On insulated piping supported by roller supports or trapeze supports (angle iron) provide at each hanger or support a protection saddle of 16 ga. galvanized sheet steel, rolled to match the outside diameter of the insulation. The saddle shall cover approximately the bottom one third of the circumference of the insulation. The length shall be at least as long as that recommended by the insulation manufacturer as published in their data.

.25 On insulated pipe up to and including 50 mm (2") pipe, clevis hangers shall be sized to suit the O.D. of the pipe. On insulated pipe of 63 mm (2½") and above, the hangers shall be sized to suit the O.D. of the insulation and protection saddles, as described above shall be installed.

.26 Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.4 Sleeves

.1 Set sleeves in position in formwork. Provide reinforcing around sleeves.

.2 Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

.3 Extend sleeves through floors 25mm (1 inch) above finished floor level. Caulk sleeves.

.4 All sleeves in mechanical rooms, janitors closets and washrooms shall extend 100 mm (4") above the finished floor level to prevent water seeping down.

.5 Install galvanized oversize pipe sleeves on all pipes passing through walls or partitions, for building into wall construction by other trades.

.6 All sleeves are to be large enough to accommodate pipe insulation as specified.

.7 The Mechanical Division shall include in tender price all cost of drilling for sleeves up to 175 mm (7") in precast sections relative to work under Mechanical Division. Prior to drilling all openings/locations must be checked by the Contract Administrator. Drilling shall be done using diamond core drilling machinery.

.8 Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with insulation and caulk, air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

.9 Install stainless steel escutcheons at finished surfaces.

3.5 Schedules

.1 Maximum spacing between pipe supports:

.1 Hangers shall be installed not more than 12” (300mm) from each change in direction of pipes.

.2 Where there are concentrations of valves and fittings, closer spacing will be necessary.

.3 Steel Pipe:

.1	Up to 50mm (2")	2.4m (8 ft.)
.2	65mm (2½”) to 150mm (6”)	3.6m (12 ft.)
.3	200mm (8”) to 300mm (12”)	5.4m (18 ft.)
.4	350mm (14”) to 450mm (18”)	7.2m (24 ft.)
.5	500mm (20”) to 600mm (24”)	9.0m (30 ft.)

.4 Copper Tubing (Hard):

.1	Up to 25mm (1")	1.8m (6 ft.)
.2	32mm (1½”) to 50mm (2”)	2.4m (8 ft.)
.3	63mm (2 ½”) to 75mm (3”)	3.0m (10 ft.)
.4	100mm (4”) to 150mm (6”)	3.6m (12 ft.)
.5	200mm (8”) to 300mm (12”)	4.8m (16 ft.)

.5 Cast Iron Pipe

.1 Maximum spacing – maximum 5 ft. (1.5m)

.2 Support M.J. pipe on both sides of joint. Provide with sway braces and anchors to Contract Administrator’s approval. At multiple fittings, or short lengths, support every 300mm (12”).

.6 Plastic (PVC, CPVC, PEX)

.1	As recommended by manufacturer for corresponding sizes and materials.	
.2	All sizes – do not exceed	1.2m (4 ft).

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Testing, adjustment, and balancing of air systems.

.2 Fire and smoke damper testing & verification.

.3 Testing, adjustment, and balancing of hydronic systems.

.4 Measurement of final operating condition of HVAC systems.

1.2 Related Sections

.1 D1 – Summary of Work

.2 Section 01 45 00 - Quality Assurance:

- .1 Testing laboratory services.
- .2 Employment of testing agency and payment for services.
- .3 Inspection and testing allowances.

.3 Section 21 05 00 - Closeout Submittals:

- .1 Starting of Systems.
- .2 Testing, Adjusting, and Balancing of Systems.

.4 Section 23 31 00 - Duct Work

.5 Section 23 33 00 - Duct Work Accessories

1.3 References

.1 AABC - National Standards for Total System Balance.

.2 CAABC – Canadian Associated Air Balance Council

.3 ADC - Test Code for Grilles, Registers, and Diffusers.

.4 ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.

.5 CSA B149.1 - Natural gas and propane installation code

.6 SMACNA - HVAC Systems Testing, Adjusting, and Balancing.

1.4 Submittals

.1 Section 21 05 00: Procedures for submittals.

.2 Submit name of adjusting and balancing agency for approval within 30 days after award of Contract.

.3 Submit draft copies of report for review prior to final acceptance of Project. Draft copies shall be submitted in electronic format (Adobe Acrobat PDF file). Provide final copies for Contract Administrator and for inclusion in operating and maintenance manuals.

.4 Provide final reports in letter size, soft cover or as suitable for insertion in the project Operation and Maintenance manuals, complete with index page and indexing tabs, with cover identification at front and side. Also submit an electronic copy (PDF file) of the same. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

.5 Test Reports: Indicate data on AABC National Standards for Total System Balance forms. Submit data in either S.I. Metric or IP units to match the primary units used on the drawings and schedules.

1.5 Project Record Documents

.1 Section 21 05 00: Submittals for project closeout.

.2 Record actual locations of flow measuring stations, balancing valves, balancing dampers, and fire dampers.

1.6 Quality Assurance

.1 Perform total system balance to AABC National Standards for Field Measurement and Instrumentation, Total System Balance.

1.7 Qualifications

.1 Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience, and certified by CAABC.

.2 Perform Work under supervision of CAABC Certified Test and Balance Supervisor.

1.8 Pre-balancing Conference

.1 Convene one week prior to commencing work of this section, to Section 21 05 00.

1.9 SEQUENCING

.1 Sequence work to D1.

.2 Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

1.10 Scheduling

.1 Schedule work to Section 21 05 00.

.2 Schedule and provide assistance in final adjustment and test of life safety, smoke evacuation, and/or smoke control system with Fire Authority.

1.11 Project Close-out

.1 The Testing, Adjusting and Balancing agency as part of its contract shall act as authorized inspection agency, responsible to list all items that are installed incorrectly, require correction or have not been installed in accordance with contract drawings and/or specifications, pertaining to the air distribution, cooling and heating systems. The Mechanical Contractor shall make good these items.

.2 Final payment on the building will not be issued until the final air balance report has been submitted to the Contract Administrator and has been approved by the Contract Administrator.

Part 2 Products

.1 Not used

Part 3 Execution

3.1 Agencies

.1 Air Movement Services Ltd.

.2 Airdronics Inc.

.3 D.F.C. Mechanical Testing & Balancing Ltd.

.4 AHS Testing & Balancing.

3.2 Examination

.1 Verify that systems are complete and operable before commencing work. Ensure the following conditions:

- .1 Systems are started and operating in a safe and normal condition.
- .2 Temperature control systems are installed complete and operable.
- .3 Proper thermal overload protection is in place for electrical equipment.
- .4 Final filters are clean and in place. If required, install temporary media in addition to final filters.
- .5 Duct systems are clean of debris.
- .6 Fans are rotating correctly.
- .7 Fire and volume dampers are in place and open.
- .8 Access doors are closed and duct end caps are in place.
- .9 Air outlets are installed and connected.
- .10 Duct system leakage is minimized.

.2 Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

.3 Beginning of work means acceptance of existing conditions.

3.3 Preparation

.1 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Contract Administrator to facilitate spot checks during testing.

.2 Provide additional balancing devices as required.

3.4 Installation Tolerances

.1 Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

.2 Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.5 Adjusting

.1 Ensure recorded data represents actual measured or observed conditions.

.2 Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

.3 Make any changes in pulleys and belts, and add any manual dampers as required for correct balance, at no additional cost to the The City.

.4 After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

3.6 AIR SYSTEM PROCEDURE

.1 Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

.2 Test and record motor full load amperes.

.3 Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

.4 Measure air quantities at air inlets and outlets.

.5 Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

.6 Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

.7 All outlets shall be adjusted to provide proper throw and directional distribution in accordance with the requirements on the drawings and/or schedules.

.8 Vary total system air quantities by adjustment of fan speeds.

.1 Provide drive changes required to set airflows on belt driven units.

.2 Adjust fan motor speed using speed control, on electronic commutated (EC) motors and variable speed drives (VSD) serving AC motors. Indicate speed voltage (0-10 DC) on EC motors and hertz (Hz) on VSD

.3 Vary branch air quantities by damper regulation.

.9 Provide system schematic with required and actual air quantities recorded at each outlet or inlet. Each grille, diffuser and register shall be identified as to location and area. Include locations of pitot tube traverse locations, fire damper locations and tags, and balance damper locations.

.10 Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

.1 Test and record entering air temperatures (D.B. heating and cooling).

.2 Test and record entering air temperatures (W.B. cooling).

.3 Test and record leaving air temperatures (D.B. heating and cooling).

.4 Test and record leaving air temperatures (W.B. cooling).

.11 Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 12.5 Pa (0.05 inches) positive static pressure near the building entries.

.12 All pitot-tube openings shall have plastic plugs of proper size in uninsulated or internally insulated ductwork. Insulated ductwork shall be provided with rubber plugs that extend to the face of the insulation. Cover the plugs on insulated ductwork with strip of grey tape.

.13 After completion of final balance, the Balance Contractor shall permanently fix the damper operator with a strip of contact tape and spray the quadrant with bright paint to permanently mark its balanced position.

3.1 FIRE & SMOKE DAMPER TESTING & VERIFICATION

.1 Testing of Fire Dampers, Ceiling Fire Stops and/or Fire/Smoke Dampers

.1 General

.1 The Testing, Adjusting and Balancing agency shall test this equipment after installation.

.2 Test and verify operation of all fire dampers and ceiling fire stops in this project.

.3 Test shall include manually releasing fusible link; allowing damper to close to ensure that it has tight-fit closing operation without binding; opening fire damper and/or closing ceiling fire stop and resetting fusible link connection.

.4 Instruct Sections 23 31 00 and 23 33 00 to repair all fire dampers and/or ceiling fire stops that have been identified as being faulty.

.2 Identification of Fire Dampers and Ceiling Fire Stops

.1 At all fire dampers and ceiling fire stops, supply and install tags as approved by the Consultant.

.2 Tags shall be mechanically fastened to duct fire damper access door, or onto or on structure near fire dampers or ceiling fire stops which have no connecting ductwork.

.3 After each fire damper has been tested and has been proven to operate satisfactorily as noted in previous clause, a representative of the Testing, Adjusting and Balancing agency shall label unit number and mark date and signature on tag. Tags shall have space for minimum size further dates and signatures for future checking of damper operation by Owner's staff.

.3 Test Report for Fire Dampers and Ceiling Fire Stops

.1 The Testing, Adjusting and Balancing agency shall provide a Test Report.

.2 The report shall include following for each fire damper:

.1 Verification that the unit is fully accessible.

.2 Verification that the unit has been successfully tested.

.3 Verification that the unit has been reset.

.4 Name of tester.

.5 Date that the unit tested successfully.

.6 Location schedule of all dampers i.e. each damper must be labelled.

.3 Provide one copy of completed report to Consultant. After the Consultant has reviewed report, provide to the Mechanical Subtrade

sufficient copies of report to insert one in each Maintenance/Operating Manual.

.4 Testing of Fire/Smoke Dampers

.1 Provide all testing, tagging, and Test Report for all Fire/Smoke Dampers.

.2 Follow instruction noted in previous clause as noted for Fire Dampers and Ceiling fire stops.

3.2 Schedules

.1 Equipment requiring testing, adjusting and balancing:

.1 Sprinkler Air Compressor

.2 Plumbing Pumps

.3 Fans

.2 Report Forms

.1 Title Page:

.1 Name of Testing, Adjusting, and Balancing Agency

.2 Address of Testing, Adjusting, and Balancing Agency

.3 Telephone number of Testing, Adjusting, and Balancing Agency

.4 Project name

.5 Project location

.6 Project Architect

.7 Project Engineer

.8 Project Contractor

.9 Project altitude

.10 Report date

.2 Summary Comments:

.1 Design versus final performance

.2 Notable characteristics of system

.3 Description of systems operation sequence

.4 Summary of outdoor and exhaust flows to indicate amount of building pressurization

.5 Nomenclature used throughout report

.6 Test conditions

.3 Instrument List:

.1 Instrument

.2 Manufacturer

.3 Model number

.4 Serial number

.5 Range

.6 Calibration date

.4 Electric Motors:

.1 Manufacturer

.2 Model/Frame

.3 HP/BHP

.4 Phase, voltage, amperage; nameplate, actual, no load

.5 RPM

.6 Service factor

.7 Starter size, rating, heater elements
.8 Sheave Make/Size/Bore

.5 V-Belt Drive:
.1 Identification/location
.2 Required driven RPM
.3 Driven sheave, diameter and RPM
.4 Belt, size and quantity
.5 Motor sheave diameter and RPM
.6 Centre to centre distance, maximum, minimum, and actual

.6 Exhaust Fan Data:
.1 Location
.2 Manufacturer
.3 Model number
.4 Serial number
.5 Air flow, specified and actual
.6 Total static pressure (total external), specified and actual
.7 Inlet pressure
.8 Discharge pressure
.9 Sheave Make/Size/Bore
.10 Number of Belts/Make/Size
.11 Fan RPM

.7 Duct Traverse:
.1 System zone/branch
.2 Duct size
.3 Area
.4 Design velocity
.5 Design air flow
.6 Test velocity
.7 Test air flow
.8 Duct static pressure
.9 Air temperature
.10 Air correction factor

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Metal duct work.

.2 Buried duct work.

.3 Duct cleaning.

1.2 Related Sections

.1 D1 - Summary of Work..

.2 Section 03 30 00 - Cast-in-place Concrete.

.3 Section 09 90 00 – Painting.

.4 Section 23 05 29 - Supports And Anchors: Sleeves.

.5 Section 23 05 93 - Testing, Adjusting, And Balancing.

.6 Section 23 07 13 - Duct Insulation: External insulation and duct liner.

.7 Section 23 33 00 - Duct Work Accessories.

.8 Section 23 37 00 - Air Outlets And Inlets.

1.3 References

.1 ASTM A36/A36M - Carbon Structural Steel.

.2 ASTM A90/A90M - Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

.3 ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.4 ASTM A480/A480M - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

.5 ASTM A568/A568M - General Requirements for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.

.6 ASTM A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.7 ASTM A1008/A1008M - Steel, Sheet, Cold-Rolled Carbon, Structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Formability.

.8 ASTM A1011/A1011M - Standard Specification for Steel, Sheet, and Strip Hot-Rolled, Carbon, Structural, High-Strength, Low-Alloy with Improved Formability.

.9 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

.10 AWS D9.1 - Sheet Metal Welding Code.

.11 NBS PS 15 - Voluntary Product Standard for Custom Contact-Moulded Reinforced-Polyestor Chemical Resistant Process Equipment.

.12 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

.13 NFPA 90B - Installation of Warm Air Heating and Air-Conditioning Systems.

.14 NFPA 91 - Exhaust Systems for Air Conveying of Vapours, Gases, Mists, and Noncombustible Particulate Solids.

.15 NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Operations.

.16 SMACNA - HVAC Air Duct Leakage Test Manual.

.17 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

.18 UL 181 - Factory-Made Air Ducts and Connectors.

1.4 PERFORMANCE REQUIREMENTS

.1 No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts to ASHRAE table of equivalent rectangular and round ducts.

1.5 Submittals

.1 Section 21 05 00: Procedures for submittals.

1.6 Project Record Documents

.1 Section 21 05 00: Submittals for project closeout.

.2 Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.7 Quality Assurance

.1 Perform Work to SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

.2 Maintain one copy of document on site.

1.8 Qualifications

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years' experience.

.2 Installer: Company specializing in performing the work of this section with minimum three years documented experience.

1.9 Environmental Requirements

.1 Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

.2 Maintain temperatures during and after installation of duct sealants.

Part 2 Products

2.1 MATERIALS

.1 Galvanized Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality, having G60 zinc coating of to ASTM A90.

.2 Fasteners: Rivets, bolts, or sheet metal screws.

.3 Sealant:

.1 Manufacturers:

.1 Duro-Dyne

.2 Substitutions: Refer to Section 21 05 00.

.2 Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

.4 Hanger Rod: ASTM A36; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 Duct Work Fabrication

.1 Fabricate and support to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Unless otherwise indicated fabrication shall conform to standards for duct pressure class rating of +2" w.g. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

.2 Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centreline. Where not possible and where rectangular elbows are used, provide air-foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fibre insulation.

.3 Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

.4 Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints: minimum 100 mm (4 inch) cemented slip joint, brazed or electric welded. Prime coat welded joints.

.5 Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

.6 All rectangular ducts shall be constructed by breaking the corners and grooving the longitudinal seams using Pittsburgh seam or other approved airtight seam.

.7 All elbows and transformation pieces shall be constructed using Pittsburgh corner seams or double seam corners. All transverse joints shall be constructed using S-slips, Bar Slips, Drive Slips, etc. where recommended in ASHRAE guide. All slips shall be not less than one gauge heavier than duct material. Open corners will not be accepted.

2.3 Manufactured Duct Work And Fittings

.1 Manufacture to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

Part 3 Execution

3.1 Installation

.1 Install to manufacturer's written instructions.

.2 Install and seal ducts to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.3 Duct sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.

.4 No variation of duct sizes will be permitted except by written permission of the Contract Administrator. In the event that additional offsets and changes in direction are required in the duct system, these changes shall be made by the Sheet Metal Trade without additional cost to the The City. All ductwork shall be to the recommended practices as laid down by the Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

.5 Where the width of the duct exceeds 450 mm (18") in its largest dimension such ductwork shall be suitably stiffened by breaking the sheets diagonally.

.6 If ductwork is insulated, cross breaking may be omitted providing the ducts are 2 gauges heavier than shown on the above schedule.

.7 All laps shall be in the direction of air flow. Rivets and bolts shall be used throughout. All edges and slips shall be hammered down to leave a smooth interior duct.

.8 Where low pressure ductwork conflicts with mechanical and electrical piping and it is not possible to divert the ductwork or piping to stay within allowable space limitation, provide duct easements.

.9 Easements are not required on pipes 100 mm (4") and smaller outside dimension, unless this exceeds 20% of the duct area. Any irregular or flat shaped intrusions require a duct easement. Hangers and straps in the ductwork shall be parallel to air flow. If this is not possible, provide an easement. If the easement exceeds 25% of the duct area, the duct shall be split into two ducts with the original duct area being maintained. All easements shall be approved by the Contract Administrator before installation.

.10 Provide openings in duct work where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated duct work, install insulation material inside a metal ring.

.11 Locate pitot tube test openings in ductwork at supply fan discharges, on intake of exhaust/and return air fans, in major duct branches and everywhere pitot tube openings are required for proper balancing of air conditioning, ventilation and exhaust systems. Do not place closer than 1829mm (72 inches) to elbows. Space every 150mm (6 inches) across air stream at each location. Refer to drawings for additional opening requirements.

.12 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

.13 Use crimp joints with or without bead for joining round duct sizes 200 mm (8 inch) and smaller with crimp in direction of air flow.

.14 Use only threaded rod for duct support in exposed areas. Strapping not allowed.

.15 Use double nuts and lock washers on threaded rod supports.

.16 During construction provide temporary closures of metal or taped polyethylene on open duct work to prevent construction dust from entering duct work system.

.17 Open ductwork exposed to the outdoors during construction shall also be weather proofed c/w insulation at sealed ends for any ducts exposed to sub-zero temperatures.

.18 Seal ductwork so that it is sufficiently airtight to ensure economical and quiet performance of the system. All ductwork, except where otherwise indicated, shall have seams and joints sealed with Duro-Dyne S-2 duct sealer. Apply duct sealer and duct tape in strict accordance with manufacturer's recommendations, to joints and seams to provide an airtight, watertight installation. Prior to application, ductwork to be dry and free of grease, etc. Use 6mm bead of material along joints. Material, when dry, to have 3.2mm depth extending 25mm on each side of joint or seam.

.19 All ductwork located outdoors shall have seams and joints sealed with grey TREMCO 555 acrylic sealant applied with gun and levelled with putty knife. Use material in accordance with manufacturer's printed recommendations.

.20 Install ductwork free from pulsation, chatter, vibration or objectionable noises.

.21 Should any of these defects appear after the system is in operation, correct problems by removing, replacing, or reinforcing the work as directed by the Contract Administrator.

3.2 Cleaning

.1 Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

.2 Clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into duct work for cleaning purposes.

3.3 Schedules

3.4 DUCT WORK MATERIAL SCHEDULE

	AIR SYSTEM	MATERIAL
	General Exhaust	Steel
	Outside Air Intake	Steel

3.5 Duct Work Pressure Class Schedule

	AIR SYSTEM	PRESSURE CLASS
	General Exhaust	125 Pa (1/2 inch)
	Outside Air Intake	125 Pa (1/2 inch)
	Intake and Exhaust	250 Pa (1 inch)

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Air turning devices/extractors.

.2 Backdraft dampers.

.3 Duct access doors.

.4 Duct test holes.

.5 Flexible duct connections.

.6 Fire Dampers

.7 Combination fire and smoke dampers.

.8 Volume control dampers.

1.2 Related Sections

.1 Section 23 05 48 - Vibration Isolation.

.2 Section 23 31 00 - Duct Work.

.3 Section 25 30 00 – Instrument and Control Elements

.4 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

.1 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

.2 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

.3 CAN/ULC-S112 Standard Method of Fire Test of Fire-Damper Assemblies

.4 UL 33 - Heat Responsive Links for Fire-Protection Service.

.5 UL 555 - Fire Dampers.

1.4 Submittals

.1 Section 21 05 00: Procedures for submittals.

.2 Manufacturer's Installation Instructions: Indicate for fire dampers and combination fire and smoke dampers.

1.5 Project Record Documents

.1 Section 21 05 00: Submittals for project closeout.

.2 Record actual locations of access doors.

1.6 Qualifications

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 Regulatory Requirements

.1 Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., and testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.8 Delivery, Storage, And Handling

.1 Section 21 05 00: Transport, handle, store, and protect products.

.2 Protect dampers from damage to operating linkages and blades.

Part 2 Products

2.1 AIR TURNING DEVICES/EXTRACTORS

.1 Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with push-pull operator strap.

2.2 Backdraft Dampers.

.1 Gravity Backdraft Dampers, Size 450 x 450 mm (18 x 18 inches) or smaller, provided with Air Moving Equipment: Air moving equipment manufacturers standard construction.

.2 Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: 1.5 mm (16 gauge) thick galvanized steel, with centre pivoted blades of maximum 150 mm (6 inch) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 Duct Access Doors

.1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

.2 Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated duct work, install minimum 25 mm (one inch) thick insulation with sheet metal cover.

- .1 Less than 300 mm (12 inches) Square: Secure with sash locks.
- .2 Up to 450 mm (18 inches) Square: Provide two hinges and two sash locks.
- .3 Up to 600 x 1200 mm (24 x 48 inches): Three hinges and two compression latches.
- .4 Larger Sizes: Provide an additional hinge.

.3 Access doors with sheet metal screw fasteners are not acceptable.

.4 Doors in insulated ductwork to be double panel construction with a 25mm (1") insulating filler.

.5 In certain locations where it is inconvenient to swing access doors, removable doors with 4 cam locks will be accepted. However, all such locations shall be approved by the Contract Administrator prior to installation.

2.4 Duct Test Holes

.1 Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

.2 Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation;

2.5 Flexible Duct Connections

.1 Manufacturers:

.1 Duro-Dyne.

.2 Substitutions: Refer to Section 21 05 00.

.2 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

.3 Connector: Fabric crimped into metal edging strip.

.1 Fabric: UL listed fire-retardant neoprene coated woven glass fibre fabric to NFPA 90A, minimum density 1.0 kg/sq m (30 oz per sq yd).

.2 Net Fabric Width: Approximately 75mm (3 inches) wide.

.3 Metal: 75 mm (3 inch) wide, 0.6 mm thick (24 gauge) galvanized steel.

2.6 Fire Dampers

.1 Manufacturers:

.1 Price.

.2 Nailor.

.3 Ruskin.

.4 Substitutions: Refer to Section 21 05 00.

.2 Depending on the rating of fire separation, rating, construction and testing of the fire damper will conform to most recent issue of all of following:

.1 National Building Code

.2 ULC S-112

.3 NFPA 252

.4 ULC or ULI 10(b)

.3 Use type 'B' fire dampers, i.e. blades out of air stream, to be used in all ducts passing through fire separations. Combination fire damper-balancing damper, with blades in air stream shall be used on sidewall or return, or floor mounted supply, up to maximum size of 0.372 sq.m (576 sq.in.). For sidewall return above 0.372 sq.m (576 sq.in.) in size, use a type 'A' fire damper, i.e. blades in air stream.

.4 Ceiling Dampers: Galvanized steel, 0.76 mm(22 gauge) frame and 1.5 mm (16 gauge) flap, two layers 3.2 mm (0.125 inch) ceramic fibre on top side with locking clip.

.5 Horizontal Dampers: Galvanized steel, 0.76 mm (22 gauge) frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

.6 Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except at all locations unless otherwise indicated on the drawings, and for 250 Pa (1.0 inch) pressure class ducts up to 300 mm (12 inches) in height.

.7 Multiple Blade Dampers: 1.5 mm (16 gauge) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 3.2 x 12.7 mm (1/8 x 1/2 inch) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

.8 Fusible Links: UL 33, separate at 71°C, (160°F) with adjustable link straps for combination fire/balancing dampers.

.9 Fire dampers in stainless steel exhaust duct systems shall have #316 stainless steel blades, shafts, linkage and casing. Refer to clause 'Stainless Steel Exhaust Ductwork' in this section.

2.7 Combination Fire Smoke Dampers

.1 Manufacturers:

.1 Price.
.2 Nailor.
.3 Ruskin.
.4 Substitutions: Refer to Section 21 05 00.

.2 Fabricate to NFPA 90A, 92, and UL 555S, and ULC S 112.

.3 Dampers: UL Class 1 multiple blade type fire damper, normally open automatically operated by electric actuator.

.4 Electro Thermal Link: Fusible link melting at 74 degrees C (165 degrees F); UL listed and labeled.

.5 Actuator: 24 volts, single phase, 60 Hz; rated up to 176 degrees C (350 degrees F), Design life of 30,000 full stroke cycles.

2.8 Volume Control Dampers.

.1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

.2 Splitter Dampers:

.1 Material: Same gauge as duct to 600 mm (24 inches) size in either direction, and two gauges heavier for sizes over 600 mm(24 inches).
.2 Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous hinge or rod.
.3 Operator: Minimum 6 mm (1/4 inch) diameter rod in self aligning, universal joint action, flanged bushing with set screw.

.3 Single Blade Dampers: Fabricate for duct sizes up to 150 x 760 mm (6 x 30 inch).

.4 Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 200 x 1825 mm (8 x 72 inch). Assemble centre and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

.5 End Bearings: Except in round duct work 300 mm (12 inches) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

.6 Quadrants:

.1 Provide locking, indicating quadrant regulators on single and multi-blade dampers.

.2 On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

.3 Where rod lengths exceed 750 mm (30 inches) provide regulator at both ends.

Part 3 Execution

3.1 Preparation

.1 Verify that electric power is available and of the correct characteristics.

3.2 Installation

.1 Install accessories to manufacturer's written instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

.2 Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

.3 Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust duct work to NFPA 96. Provide minimum 300 x 300 mm (12 x 12 inch) size for all fire dampers. Enlarge duct if necessary to accommodate properly sized access door.

.4 Generally access doors at heating coils shall approximate width of coil for ease of cleaning.

.5 At smoke detectors, provide 450mm x 450mm (18 x 18 inch) access doors.

.6 Provide duct test holes where indicated and required for testing and balancing purposes.

.7 Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and supported by vibration isolators. Refer to Section 23 05 48. For fans developing static pressures of 1250 Pa (5.0 inches wg) and over, cover connections with leaded vinyl sheet, held in place with metal straps.

.8 Use splitter dampers only where indicated.

.9 Provide balancing dampers on high velocity systems where indicated. Refer to Section 23 36 00.

.10 Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

.11 Do not locate single blade volume dampers immediately behind diffusers and grilles. This application does not allow uniform airflow across the outlet face.

.12 To minimize generated duct noise, locate volume dampers at least two duct diameters from a fitting and as far away as possible from the outlet or inlet.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Wall Exhauster

.2 Fan Accessories.

1.2 Related Work

.1 Section 23 05 13 - Motors.

.2 Section 23 05 48 - Vibration Isolation.

.3 Section 23 05 53 - Mechanical Identification.

.4 Section 23 05 93 – Testing, Adjusting, And Balancing.

.5 Section 23 07 13 - Duct Insulation.

.6 Section 23 31 00 - Duct Work.

.7 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

.1 AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

.2 AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

.3 AMCA 99 - Standards Handbook.

.4 AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.5 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

.6 AMCA 301 - Method of Calculating Fan Sound Ratings from Laboratory Test Data.

.7 HVI 915 - Procedure for Loudness Rating of Residential Fan Products

.8 HVI 916 - Air Flow Test Procedure

.9 ISO 1940 – Mechanical Vibration. Balance quality requirements for rotors in a constant (rigid) state.

.10 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

.11 UL/cUL 705 – Power Ventilators

.12 UL/cUL 793 - Automatically Operated Roof Vents for Smoke and Heat

1.4 Submittals

.1 Section 21 05 00: Procedures for submittals.

.2 Shop Drawings: Indicate assembly of centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

.3 Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

.4 Manufacturer's Installation Instructions.

1.5 Operation And Maintenance Data

.1 Section 21 05 00: Submittals for project closeout.

.2 Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 Delivery, Storage, And Handling

.1 Section 21 05 00: Transport, handle, store, and protect products.

.2 .Protect motors, shafts, and bearings from weather and construction dust.

1.7 Environmental Requirements

.1 Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

1.8 Extra Materials

.1 Section 21 05 00: Submittals for project closeout.

Part 2 Products

2.1 MANUFACTURERS

.1 Greenheck

.2 Loren Cook

.3 Substitutions: Refer to Section 21 05 00

2.2 GENERAL FAN COMPONENTS

.1 Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

.2 Sound Ratings: AMCA 301, tested to AMCA 300 ,and bear AMCA Certified Sound Rating Seal.

.3 Fabrication: Conform to AMCA 99.

.4 Performance Base: Sea level conditions.

.5 Temperature Limit: Maximum 150 degrees C (300 degrees F).

.6 Static and Dynamic Balance: Balance all wheels to balance grade G6.3 per ANSI S2.19 (ISO 1940). Eliminate vibration or noise transmission to occupied areas.

.7 Performance Requirements on Schedules.

.8 Wheel And Inlet: Refer to individual sections.

.9 Housing

.1 Heavy gauge steel, spot welded, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.

.2 Factory finish before assembly with enamel or prime coat.

.10 Bearings And Drives

.1 Shafts: Hot rolled steel, ground and polished, with key- way, protectively coated with lubricating oil, and shaft guard.

.2 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 11.2 kW(15 hp) and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 15 kW(20 hp) and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

.3 Belt Guard: Fabricate to SMACNA Standard; of 2.8 mm(12 gauge) thick, 20 mm(3/4 inch) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

.11 Electrical Characteristics And Components

.1 Refer to schedule

.2 Motor: Refer to Section 23 05 13.

2.3 Wall Exhausters

.1 Manufacturers:

.1 Greenheck

.2 Loren Cook

.3 Substitutions: Refer to Section 21 05 00

.2 Fan Unit: V-belt or direct driven with spun aluminum housing; resiliently mounted motor; 13 mm(1/2 inch) mesh, 2.0 mm(16 gauge) aluminum bird screen.

.3 Electrical Characteristics and Components

.1 Electrical Characteristics:

.1 See Schedule

.2 Motor: Refer to Section 23 05 13.

.3 Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to code.

.4 Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

.4 Backdraft Damper: Gravity activated, aluminum multiple blade construction, felt edged with nylon bearings.

.5 Sheaves: For V-belt drives, provide cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self aligning pre-lubricated ball bearings.

.6 Options:

.1 Wall Mounting Collar: Galvanized steel wall mounting collar.

.2 Wall Mounting Housing: Galvanized steel wall mounting insulated housing.

.3 Wire Motor guard

.4 Weatherhood

.5 Motorized Damper:

2.4 Accessories

.1 Belt automatic tensioner.

.2 Fixed Inlet Vanes: Steel construction with fixed cantilevered inlet guide vanes welded to inlet bell.

.3 Adjustable Inlet Vanes: Steel construction with blades [supported at both ends] [cantilevered] with two permanently lubricated bearings, variable mechanism [out of air stream] terminating in single control lever with control shaft for double width fans [and locking quadrant].

.4 Discharge Dampers: Parallel blade heavy duty steel damper assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control lever.

.5 Inlet/Outlet Screens: Expanded metal mounted in a welded steel frame.

.6 Belt Guard: Factory produced painted steel belt guard designed to meet supplied fan belts and drives.

.7 Access Doors: Shaped to conform to scroll, with quick opening latches and gaskets.

.8 Scroll Drain: 13 mm(1/2 inch) steel pipe coupling welded to low point of fan scroll.

.9 Shaft Seal: Aluminum, rub ring to seal the housing around the shaft.

.10 Isolation Packages: [If isolation package is selected provide the required information in this section]

.11 Weatherhood: Constructed of painted steel. Shall completely cover motor and drive compartments, be provided with appropriate vents for motor cooling and meet UL 705 requirements.

.12 Field installed factory supplied extended lubrication lines.

Part 3 Execution

3.1 Installation

.1 Install to manufacturer's written instructions.

.2 Install fans with resilient mountings and flexible electrical leads. Refer to Section 23 05 48.

.3 Install flexible connections specified in Section 23 33 00 between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm(one inch) flex between ductwork and fan while running.

.4 Install fan restraining snubbers as required. Refer to Section 23 05 48. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

.5 Provide sheaves required for final air balance.

.6 Provide safety screen where inlet or outlet is exposed.

.7 Pipe scroll drains to nearest floor drain.

.8 Provide backdraft dampers on discharge of exhaust fans and as indicated. Refer to Section 23 33 00.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Louvers.

1.2 Related Sections

.1 Section 09 90 00 – Painting.

1.3 References

.1 ADC 1062 - Air Distribution and Control Device Test Code.

.2 AMCA 500 - Method of Testing Louvers for Ratings.

.3 AMCA 511 – Certified Ratings Program

.4 AMCA 5000 - Method of Testing Dampers for Ratings.

.5 ARI 650 - Air Outlets and Inlets.

.6 ASHRAE 70 - Method of Testing for Rating the Performance of Outlets and Inlets.

.7 SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

.8 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.4 Submittals

.1 Section 21 05 00: Procedures for submittals.

.2 Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.5 Project Record Documents

.1 Section 21 05 00: Submittals for project closeout.

.2 Record actual locations of air outlets and inlets.

1.6 Quality Assurance

.1 Test and rate air outlet and inlet performance to ADC Equipment Test Code 1062 and ASHRAE 70.

.2 Test and rate louver performance to AMCA 500

.3 Certified AMCA 511 – Certified Ratings Program

1.7 Qualifications

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

Part 2 Products

2.1 Manufacturers

.1 Unless otherwise listed:

.1 Price Industries.
.2 Nailor Industries
.3 Titus
.4 Ventex.

.2 Substitutions: Refer to Section 21 05 00.

2.2 LINEAR WALL REGISTERS/GRILLES

.1 Type: Narrow Spacing Streamlined blades with 3.2 x 19 mm (1/8 x 3/4 inch) on 6 mm (1/4 inch) centres. Refer to schedule for deflection angle.

.2 Type: Wide Spacing Streamlined blades, 3.2 x 19 mm (1/8 x 3/4 inch) on 12 mm (1/2] inch) centres. Refer to schedule for deflection angle.

.3 Refer to the schedule for frame, materials of fabrication, finishes, and accessories.

Part 3 Execution

3.1 Installation

.1 Install to manufacturer's written instructions.

.2 Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

.3 All louvers shall be free of fluttering, chattering and vibration. A felt or sponge rubber gasket shall be provided behind each outlet or inlet and adequate fastenings provided to prevent leakage between the outlet and duct and wall.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Desiccant Dehumidifier units.

1.2 RELATED SECTIONS

.1 Section 23 07 13 - Duct Insulation.

.2 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCES

.1 ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

.2 SMACNA - HVAC Duct Construction Standards, Metal and Flexible.

1.4 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Procedures for submittals.

.2 Product Data: Provide catalogue data indicating general assembly, dimensions, weights, materials, and certified performance ratings.

.3 Shop Drawings: Indicate general assembly, dimensions, weights, and materials.

1.5 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submittals for information.

.2 Manufacturer's Instructions: Indicate assembly and setting operations.

1.6 SUBMITTALS AT PROJECT CLOSEOUT

.1 Section 01 78 00: Submittals for project closeout.

.2 Operation Data: Include assembly instructions, float adjustment, bleed rates, and electrical requirements.

.3 Maintenance Data: Instructions for lubrication filter replacement, cleaning and spare parts lists.

1.7 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

.2 The unit shall be manufactured and assembled in one module for ease of installation. The module shall be factory preassembled, tested, and shipped for installation on site.

1.8 REGULATORY REQUIREMENTS

.1 Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

Part 2 Products

2.1 MANUFACTURERS

.1 Manufacturer: NovelAire Model DH-1000.

.2 Other acceptable manufacturers offering equivalent products.

.1 Substitutions: Substitutions will be considered in accordance with Bidding Procedures B7 – Substitutes.

2.2 MANUFACTURED UNITS

.1 Units: Factory assembled

.2 Evaporation Performance:

.1 Air Flow: 1000 cfm.

.2 External Air Pressure Drop: 1 inch wg.

.3 Water Adsorption: 13.6 lb/hr.

2.3 CASING

.1 The casing shall be a 1" metal wall constructed of 20 gauge galvanized steel exterior and 20 gauge galvanized steel interior. All wall and roof assemblies shall be insulated 1” thick rockwool insulation. All joints shall be caulked airtight with a silicone sealant. The exterior of the unit shall be pre-painted with a corrosion resistant polyester resin coating for use in an outdoor environment.

.2 The floor decks of each section shall be lined with an underside sheathing of a minimum of 20 gauge galvanized steel. Insulation as previously specified shall be installed between the sheathing and top wearing floor surface. The top wearing surface on the floor shall be a minimum 20 gauge galvanized steel. This floor shall sustain the equipment loading and normal maintenance loading for the unit.

.3 Closures around all components, such as coils, dampers and filters, shall be provided and made airtight. Closures shall be a minimum of 20 gauge galvanized steel and shall provide solid close- off inside of the unit housing walls. No air bypass or leakage around the components will be allowed.

2.4 BASE FRAME CONSTRUCTION

.1 Units are to have a mechanically fastened galvanized steel base frame. All base frames to be suitably reinforced and braced to permit the loading, shipping, unloading and rigging to the unit.

.2 All base frames will also be constructed to allow for general handling of the completed sections without damage to the external or internal components or misalignment of factory assembled components. Lifting lugs shall be provided as designated locations on the base frame for loading, unloading and installation of the unit.

2.5 DESICCANT WHEEL

.1 Wheel Media: Wheels shall be constructed of corrugated synthetic media, with a desiccant intimately bound and uniformly and permanently dispersed throughout the matrix structure of the media. Rotors with desiccants coated, bonded, or synthesized onto the media are not acceptable due to delamination and/or erosion of the desiccant material over time. Media shall be synthetic to provide resistance to the corrosive effects from laboratory chemicals present in pharmaceutical and hospital environments as well as the corrosive effects from external outdoor air conditions. Coated aluminum is not acceptable. Face flatness of the wheel shall be maximized (+/- 0.015 in) in order to minimize wear on inner seal surfaces and to prevent cross leakage. The minimum acceptable dehumidification performance shall be as specified in the drawings/submittal.

.2 Desiccant Material: The desiccant material shall exhibit a type III isotherm to insure proper performance with low temperatures of regeneration. Lithium chloride, or lithium chloride containing desiccant shall not be used because of the deliquescent property of LiCL2 during the adsorption process.

.3 Wheel Media support system: The wheel frames shall consist of evenly spaced steel spokes, galvanized steel outer band and rigid center hub. The wheel construction should allow for post fabrication wheel alignment.

.4 Wheel Seals: The wheel face seals shall be high temperature bulb seals which are easily adjustable, and which prevent leakage at up to 8" w.c. differential pressure. Face seal shall be Teflon coated to maximize wear resistance. Periphery seals will be a bulb seal which is easily adjustable.

.5 Wheel cassette: Where used, cassettes shall be fabricated of heavy duty reinforced minimum 14 gauge galvanized steel. Bearings shall be inboard, zero maintenance, permanently sealed roller bearings or alternatively, sealed pillow block bearings for larger wheels. Drive systems shall consist of fractional horsepower A.C. drive gear motors. The drive mechanism shall be a heavy duty chain and sprocket drive assemblies. Cassette construction may be incorporated directly into unit in lieu of separate cassette.

2.6 FILTERS (UNIT INLET)

.1 Filters shall be 2" thick, pleated, disposable type filter MERV 8 high capacity filter. Air velocity through filter shall not exceed 500 fpm. Provision will be made to easily change filter by either access door or access panel.

2.7 FAN

.1 The regeneration and supply fans consist of a motor directly mounted to an impeller that draws in the desired airflow. The impeller is constructed out of corrosion resistant steel with painted finish and has backwards facing blades for adequate suction and appropriate discharge. The impeller is dynamically balanced to G=2.5 in accordance to DIN ISO 1940-1. To maintain impeller rigidity with the input shaft, the process impeller hub is constructed from aluminum or steel, depending on the application. The fan motors will have variable frequency drives (VFD) that are capable of modulating the speed and flowrate of the fan for the motors. The VFD will limit the current draw of the motor to the rated motor full load amperage to provide electrical and thermal protection for the motor.

2.8 ELECTRIC HEATERS

.1 The electric heater shall be an air duct heater type that is constructed of a durable heat resistant/high temperature frame. The electric heater shall have built in high limit

temperature switches that cuts power to the heater elements and ensures equipment safety.

2.9 CONTROLS

.1 The unit will also have a microprocessor control capable of communication with the building management system using BACnet MSTP protocol or digital input signals that will operate the regeneration and supply fans, compressor and desiccant wheel motor. The supply and regeneration fans will have VFD speed controllers. The electric heater will have a microprocessor SCR controller to regulate its output based on leaving air conditions. The unit will have appropriate temperature sensors to properly control the unit supply conditions.

Part 3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Install in ducts or casings to SMACNA HVAC Duct Construction Standards, Metal and Flexible.

.3 Insulate exterior of unit same as specified for ductwork. Refer to Section 23 07 13.

.4 Coordinate connection to electrical supply with Division 26.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Thermostats.

.2 Humidistats.

.3 Dampers Motorized

.4 Damper operators.

.5 Miscellaneous accessories.

1.2 Related Sections

.1 Section 23 05 19 - Gages And Meters: Thermometer sockets, gauge taps.

.2 Section 23 05 48 - Vibration Isolation.

.3 Section 23 33 00 - Duct Work Accessories: Installation of automatic dampers.

.4 Section 25 50 02 - Digital Control Equipment.

.5 Section 25 90 00 - Sequence Of Operation.

.6 Section 26 27 26 - Wiring Devices: Elevation of exposed components.

.7 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 References

.1 AMCA 500 - Test Methods for Louvres, Dampers and Shutters.

.2 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.3 ASTM B32 - Solder Metal.

.4 ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.5 ASTM D1693 - Environmental Stress - Cracking of Ethylene Plastics.

.6 NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

1.4 Submittals For Review

.1 Section 21 05 00: Procedures for submittals.

.2 Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

.3 Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves

indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

1.5 Submittals For Information

.1 Section 21 05 00: Submittals for information.

.2 Manufacturer's Instructions: Provide for all manufactured components.

1.6 Submittals At Project Closeout

.1 Section 21 05 00: Submittals for project closeout.

.2 Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.

.3 Revise shop drawings to reflect actual installation and operating sequences.

.4 Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

.5 Warranty: Submit manufacturer’s warranty and ensure forms have been filled out in The City’s name and registered with manufacturer.

1.7 Quality Assurance

.1 Manufacturer Qualifications: Manufacturer shall be Johnson Controls Metasys to match existing building DDC system.

.2 The Installer shall have an established working relationship with the Control System Manufacturer and be the authorized representative of the Manufacturer at bid time.

.3 The Installer shall have successfully completed Control System Manufacturer's classes on the control system. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.

.4 All products used in this installation shall be new, currently under manufacture, and shall be applied in standard off-the-shelf products. This installation shall not be used as a test site for any new products unless explicitly approved by the Contract Administrator in writing. Spare parts shall be available for at least 5 years after completion of this contract.

1.8 Regulatory Requirements

.1 All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, provincial, and national authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:

.1 Canadian Electric Code (CEC)
.2 National Building Code (NBC)
.3 ASHRAE 135
.4 Underwriters Laboratories UL916

1.9 Warranty

.1 Section 21 05 00: Submittals for project closeout.

.2 Labor and materials for the control system specified shall be warranted free from defects for a period of 12 months after final completion and acceptance. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to The City. The Contractor shall respond to The City's request for warranty service within 24 hours during normal business hours.

.3 All work shall have a single warranty date, even when The City has received beneficial use due to an early system start-up. If the work specified is split into multiple contracts or a multi-phase contract, then each contract or phase shall have a separate warranty start date and period

.4 Operator workstation software, project-specific software, graphic software, database software, and firmware updates which resolve known software deficiencies as identified by the Contractor shall be provided at no charge during the warranty period. Any upgrades or functional enhancements associated with the above mentioned items also can be provided during the warranty period for an additional charge to The City by purchasing an in-warrant technical support agreement from the Contractor. Written authorization by The City must, however, be granted prior to the installation of any of the above-mentioned items.

.5 Exception: The Contractor shall not be required to warrant reused devices, except for those that have been rebuilt and/or repaired. The Contractor shall warrant all installation labour and materials, however, and shall demonstrate that all reused devices are in operable condition at the time of Contract Administrator review.

1.10 Maintenance Service

.1 Section 21 05 00: Submittals for project closeout.

.2 Provide service and maintenance of control system from Date of Substantial Completion.

.3 Provide complete service of controls systems, including call backs. Make minimum of two complete normal inspections of approximately four (4) hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

1.11 SYSTEM AND COMPONENT PERFORMANCE

.1 Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).

.2 Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.

.3 Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.

.4 Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.

.5 Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.

.6 Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 45 seconds

.7 Object Scan. All changes of state and change of analog values will be transmitted over the high-speed Ethernet network such that any data used or displayed at a controller or workstation will have been current within the previous 2 seconds

.8 Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.

.9 Reporting Accuracy. System shall report values with minimum end-to-end accuracy listed in Table 1.

.10 Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances listed in Table 2.

Table 1
Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5ºC (±1ºF)
Ducted Air	±0.5ºC (±1ºF)
Outside Air	±1.0ºC (±2ºF)
Dew Point	±1.5ºC (±3ºF)
Water Temperature	±0.5ºC (±1ºF)
Delta-T	±0.15ºC (±0.25ºF)
Relative Humidity	±5% RH
Water Flow	±2% of full scale
Airflow (terminal)	±10% of full scale (see Note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±25 Pa (±0.1 in. w.g.)
Air Pressure (space)	±3 Pa (±0.01 in. w.g.)
Water Pressure	±2% of full scale (see Note 2)
Electrical (A, V, W, Power Factor)	±1% of reading (see Note 3)
Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO 2)	±30 ppm

Table 2
Control Stability and Accuracy

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa (±0.2 in. w.g.) ±3 Pa (±0.01 in. w.g.)	0-1.5 kPa (0-6 in. w.g.) -25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Airflow	±10% of full scale	
Space Temperature	±1.0ºC (±2.0ºF)	
Duct Temperature	±1.5ºC (±3ºF)	
Humidity	±5% RH	
Fluid Pressure	±10 kPa (±1.5 psi) ±250 Pa (±1.0 in. w.g.)	MPa (1-150 psi) 0-12.5 kPa (0-50 in. w.g.) differential

Part 2 Products

2.1 Control Panels

.1 Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.

.2 NEMA 250, general purpose utility enclosures with enamelled finished face panel.

.3 Provide common keying for all panels.

2.2 DAMPERS - MOTORIZED

.1 Tamco Model 1500 or 9000 SC (Insulated).

.2 Other Acceptable Manufacturers:

.1 Alumavent

.2 Johnson Controls

.3 Substitutions: Substitutions will be considered in accordance with Bidding Procedures B7 - Substitutes.

.3 Performance: Test to AMCA 500.

.4 Frames: Extruded aluminum, welded or riveted with corner reinforcement, minimum 2.0 mm (0.081 inch) thick. Damper frame is 100mm (4 inch) deep.

.5 All dampers for duct sizes with a dimension (either width or height) 300 mm (12 inches) or less shall be flanged to the duct. In-duct frames not allowed.

.6 Blades: Extruded aluminum air foil profile, maximum blade size 150 mm (6 inches) wide, maximum blade length section 1200 mm (48 inches).

.7 Insulation : Internally insulated with expanded polyurethane foam and are thermally broken. Complete blade has an insulating factor of R-2.29 and a temperature index of 55.

.8 Blade Seals: Extruded silicone mechanically attached, field replaceable.

.9 Frame/Jamb Seals: Extruded silicone mechanically attached, field replaceable.

.10 Bearings: Celcon inner bearing fixed to a 7/16” (11.11 mm) aluminum hexagon blade pivot pin, rotating within a polycarbonate outer bearing inserted in the frame,

.11 Linkage: Installed in frame side and constructed of aluminum and corrosion-resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.

.12 Leakage: Class 1A at 0.25 kPa (1 in. w.g.) static pressure differential. Class 1 at 1 kPa (4 in. w.g.) static pressure differential. Standard air leakage data is certified under the AMCA Certified Ratings Program.

.13 Maximum blade length Static Pressure: 1.0 kPa (4 inches wg)

.14 Temperature Limits: -40 to 100 degrees C (-40 to 212 degrees F).

2.3 Damper Operators

.1 General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.

.2 Electric Operators:

.1 Acceptable manufacturers.

.1 Belimo

.2 Siemens

.3 Honeywell

.4 Schneider Electric

.5 Johnson Controls

.2 Substitutions: Refer to Section 21 05 00.

.3 Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch minimum position potentiometer

.4 Number: Sufficient to achieve unrestricted movement throughout damper range.

2.4 Input/output Sensors

.1 Temperature:

.1 Resistance temperature detectors with resistance tolerance of plus or minus 0.1 percent at 21 degrees C (70 degrees F), interchangeability less than plus or minus 0.2 percent, time constant of 13 seconds maximum for fluids and 200 seconds maximum for air.

.2 Measuring current maximum 5 mA with maximum self-heat of 0.017 degrees C/mW(0.031 degrees F/mW) in fluids and 0.008 degrees C/mW(0.014 degrees F/mW) in air.

.3 Provide 3 lead wires and shield for input bridge circuit.

.4 Use insertion elements in ducts not affected by temperature stratification or smaller than one square metre. Use averaging elements where larger or prone to stratification sensor length 2.5 m(8 feet) or 5 m(16 feet) as required.

.5 Insertion elements for liquids: with brass socket, minimum insertion length of 60 mm(2-1/2 inches).

.6 Room sensors: Locking cover.

.7 Outside air sensors: Watertight inlet fitting, shielded from direct rays of sun.

.8 Room security sensors: Stainless steel cover plate with insulated back and security screws.

.2 Humidity Sensors:

.1 Elements: Accurate within 5 percent full range with linear output.

.2 Room Sensors: With locking cover, span of 10 to 80 percent relative humidity

.3 Duct and Outside Air Sensors: With element guard and mounting plate, range of 0 100 percent relative humidity.

.3 Static Pressure Sensors:

.1 Unidirectional with ranges not exceeding 150 percent of maximum expected input.

.2 Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 5 to 40 degrees C (40 to 100 degrees F).

.3 Accuracy: One percent of full scale with repeatability 0.3 percent.

.4 Output: 0 - 5 vdc with power at 12 to 28 vdc.

.4 Equipment Operation Sensors:

.1 Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 1250 Pa (0 to 5 inches wg).

.2 Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 50 to 400 kPa (8 to 60 psi).

.3 Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

.5 Damper Position Indication: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 - 100 percent damper travel.

2.5 Relays.

.1 Control Relays. Control relays shall be plug-in type, ULC/CSA listed, and shall have dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.

.2 Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable ±100% from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.

2.6 Current Transformers.

.1 AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.

.2 Transformers shall be available in various current ratios and shall be selected for ±1% accuracy at 5 A full-scale output.

.3 Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.

2.7 Voltage Transformers.

.1 AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.

.2 Transformers shall be suitable for ambient temperatures of 4°C-55°C (40°F-130°F) and shall provide ±0.5% accuracy at 24 Vac and 5 VA load.

.3 Windings (except for terminals) shall be completely enclosed with metal or plastic.

2.8 Current Switches.

.1 Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.

Part 3 Execution

3.1 Examination

.1 Section 21 05 00: Verification of existing conditions before starting work.

.2 Verify that systems are ready to receive work.

.3 Beginning of installation means installer accepts existing conditions.

.4 Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

.5 Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

.6 Ensure installation components are complementary to installation of similar components.

.7 Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

.8 The Contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate — or if any discrepancies occur between the plans and the Contractor's work, and the plans and the work of others — the Contractor shall report these discrepancies to the Contract Administrator and shall obtain written instructions for any changes necessary to accommodate the Contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the Contractor to report such discrepancies shall be made by — and at the expense of — this Contractor.

3.2 Installation

.1 Install to manufacturers written instructions.

.2 Check and verify location of exposed control sensors with plans and room details before installation.

.3 Mount freeze protection thermostats using flanges and element holders.

.4 Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun and wind shield.

.5 Provide separable sockets for liquids and flanges for air bulb elements. Refer to Section 23 05 19.

.6 Provide guards or password protection on thermostats in entrances and other public areas.

.7 Provide valves with position indicators and with pilot positioners where sequenced with other controls.

.8 Provide isolation (two position) dampers of parallel blade construction.

.9 Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

.10 Coordinate location of the differential pressure sensor as shown on the drawings. If not shown on the drawings locate the pressure sensor at the furthest and most flow demanding pipe branch in the system. Show location on shop drawings and on GUI.

.11 Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in

same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

.12 Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position for equipment not signalled by fire alarm system.

.13 Provide conduit and electrical wiring to Section 26 05 80. Electrical material and installation to appropriate requirements of Division 26.

3.3 Manufacturer's Field Services

.1 Section 21 05 00: Prepare and start systems.

.2 Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

3.4 Demonstration And Instructions

.1 Section 21 05 00: Demonstrating installed work.

.2 Demonstrate complete and operating system to The City.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Control equipment.

.2 Software.

1.2 Related Sections

.1 Section 25 30 00 - Instruments And Control Elements.

.2 Section 25 50 01 - Analog Control Equipment.

.3 Section 25 90 00 - Sequence Of Operation.

.4 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

.5 REFERENCES

.6 NEMA EMC1 - Energy Management Systems Definitions.

.7 NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

.8 NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

.9 ASHRAE Standard 135-2012 -- BACnet®--A Data Communication Protocol for Building Automation and Control Networks

1.3 System Description

.1 Automatic temperature control field monitoring and control system using field programmable micro-processor based units with communications to Building Management System specified in Section 25 30 00.

.2 Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

.3 Include control units, sensors, control devices, actuators, connection to existing controls network.

.4 Provide control systems consisting of dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

.5 Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

.6 All controls shall be Johnson Controls Metasys to match and connect to existing building DDC System.

1.4 Submittals For Review

.1 Section 21 05 00: Procedures for submittals.

.2 Product Data: Provide data for each system component and software module.

.3 Shop Drawings:

.1 Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.

.2 List connected data points, including connected control unit and input device.

.3 Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.

.4 Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

.5 Indicate description and sequence of operation of operating, user, and application software.

1.5 Submittals For Information

.1 Section 21 05 00: Submittals for information.

.2 Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

1.6 Submittals At Project Closeout

.1 Section 21 05 00: Submittals for project closeout.

.2 Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.

.1 Revise shop drawings to reflect actual installation and operating sequences.

.2 Include data specified in "Submittals" in final "Record Documents" form.

.3 Operation and Maintenance Data:

.1 Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.

.2 Include keyboard illustrations and step-by-step procedures indexed for each operator function.

.3 Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

.4 Warranty: Submit manufacturers warranty and ensure forms have been filled out in The City’s name and registered with manufacturer.

1.7 Quality Assurance

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented install experience.

.2 Installer Qualifications: Company specializing in performing the work of this section with documented experience and approved by manufacturer.

1.8 Regulatory Requirements

.1 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.9 Warranty

.1 Section 21 05 00: Submittals for project closeout.

.2 Correct defective Work within one year period after Substantial Completion.

.3 Provide five year manufacturer's warranty for field programmable micro-processor based units.

1.10 Maintenance Service

.1 Section 21 05 00: Submittals for project closeout.

.2 Provide service and maintenance of energy management and control systems for one two years from Date of Substantial Completion.

.3 Provide four complete inspections per year, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

.4 Provide complete service of systems, including call backs.

1.11 Extra Materials

.1 Section 21 05 00: Submittals for project closeout.

1.12 Protection Of Software Rights

.1 Prior to delivery of software, The City and the party providing the software will enter into a software license agreement with provisions for the following:

.1 Limiting use of software to equipment provided under these specifications.
.2 Limiting copying.
.3 Preserving confidentiality.
.4 Prohibiting transfer to a third party.

Part 2 Products

2.1 APPROVED AGENCIES

.1 Johnson Controls Metasys to match existing building DDC system.

2.2 Control Units

.1 Units: Modular in design and consisting of processor board with programmable RAM memory, local operator access and display panel, and integral interface equipment.

.2 Battery Backup: For minimum of 48 hours for complete system including RAM without interruption, with automatic battery charger.

.3 Control Units Functions:

.1 Monitor or control each input/output point.
.2 Completely independent with hardware clock/calendar and software to maintain control independently.
.3 Acquire, process, and transfer information to operator station or other control units on network.

.4 Accept, process, and execute commands from other control unit's or devices or operator stations.

.5 Access both data base and control functions simultaneously.

.6 Record, evaluate, and report changes of state or value that occur among associated points. Continue to perform associated control functions regardless of status of network.

.7 Perform in stand-alone mode:

.1 Start/stop.

.2 Duty cycling.

.3 Automatic Temperature Control.

.4 Demand control via a sliding window, predictive algorithm.

.5 Event initiated control.

.6 Calculated point.

.7 Scanning and alarm processing.

.8 Full direct digital control.

.9 Trend logging.

.10 Global communications.

.11 Maintenance scheduling.

.4 Data Communication Protocol

.1 BACnet

.5 Global Communications:

.1 Broadcast point data onto network, making that information available to all other system control units.

.2 Transmit any or all input/output points onto network for use by other control units and utilize data from other control units.

.6 Input/Output Capability:

.1 Discrete/digital input (contact status).

.2 Discrete/digital output.

.3 Analog input.

.4 Analog output.

.5 Pulse input (5 pulses/second).

.6 Pulse output (0-655 seconds in duration with 0.01 second resolution).

.7 Monitor, control, or address data points. Include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs, as required. Install control unit's with minimum 30 percent spare capacity.

.8 Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.

.9 Upload/Download Capability: Download from or upload to operator station. Upload/Download time for entire control unit database maximum 10 seconds on hard wired LAN, or 60 seconds over voice grade phone lines.

.10 Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:

.1 Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from work station.

.2 Control output points but change only data base state or value; leave external field hardware unchanged.

.3 Enable control actions on output points but change only data base state or value.

.11 Local display and adjustment panel: Portable control unit, containing digital display, and numerical keyboard. Display and adjust:

.1 Input/output point information and status.
.2 Controller set points.
.3 Controller tuning constants.
.4 Program execution times.
.5 High and low limit values.
.6 Limit differential.
.7 Set/display date and time.
.8 Control outputs connected to the network.
.9 Automatic control outputs.
.10 Perform control unit diagnostic testing.
.11 Points in "Test" mode.

2.3 Local Area Networks (LAN):

.1 Provide communication between control units over local area network (LAN).

.2 LAN Capacity: Not less than the require stations or nodes to complete the installation.

.3 Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

.4 LAN Data Speed: Minimum 1000 Mbps.

.5 Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

.6 Transmission Median: Ethernet Cat 6 or single pair of solid 24 gauge twisted, shielded copper cable(MS/TP).

.1 MS/TP
  .1 Daisy chain maximum, 20 nodes/controls
  .2 Baud Rate: Minimum of 57600 bps

.7 Network Support: Less than 3 seconds for global point to be received by any station. Automatically reconfigure if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.4 Operating System Software

.1 Input/Output Capability From Operator Station:

.1 Request display of current values or status in tabular or graphic format.
.2 Command selected equipment to specified state.
.3 Initiate logs and reports.

.4 Change analog limits.

.5 Add, delete, or change points within each control unit or application routine.

.6 Change point input/output descriptors, status, alarm descriptors, and engineering unit descriptors.

.7 Add new control units to system.

.8 Modify and set up maintenance scheduling parameters.

.9 Develop, modify, delete or display full range of colour graphic displays.

.10 Automatically archive select data even when running third party software.

.11 Provide capability to sort and extract data from archived files and to generate custom reports.

.12 Support two printer operations.

.1 Alarm printer: Print alarms, operator acknowledgements, action messages, system alarms, operator sign-on and sign-off.

.2 Data printer: Print reports, page prints, and data base prints.

.13 Select daily, weekly or monthly as scheduled frequency to synchronize time and date in digital control units. Accommodate daylight savings time adjustments.

.14 Print selected control unit data base.

.2 Operator System Access: Via software password with minimum 30 access levels at work station and minimum 3 access levels at each control unit.

.3 Data Base Creation and Support: Use standard procedures for changes. Automatically check work station data base files upon connection and verify data base match. Minimum capability:

.1 Add and delete points.

.2 Modify any point parameter.

.3 Change, add, or delete English language descriptors.

.4 Add, modify, or delete alarm limits.

.5 Add, modify, or delete points in start/stop programs, trend logs, etc.

.6 Create custom relationship between points.

.7 Create or modify DDC loops and parameters.

.8 Create or modify override parameters.

.9 Add, modify, and delete any applications program.

.10 Add, delete, develop, or modify dynamic colour graphic displays.

.4 Dynamic Colour Graphic Displays:

.1 Utilizes custom symbols or system supported library of symbols.

.2 Sixteen (16) colours.

.3 Sixty (60) outputs of real time, live dynamic data per graphic.

.4 Dynamic graphic data.

.5 1,000 separate graphic pages.

.6 Modify graphic screen refresh rate between 1 and 60 seconds.

.5 Operator Station:

.1 Accept data from LAN as needed without scanning entire network for updated point data.

.2 Interrogate LAN for updated point data when requested.

.3 Allow operator command of devices.

.4 Allow operator to place specific control units in or out of service.

.5 Allow parameter editing of control units.

.6 Store duplicate data base for every control unit and allow down loading while system is on line.

.7 Control or modify specific programs.

.8 Develop, store and modify dynamic colour graphics.

.9 Provide data archiving of assigned points and support overlay graphing of this data utilizing up to four (4) variables.

.6 Alarm Processing:

.1 Off normal condition: Cause alarm and appropriate message, including time, system, point descriptor, and alarm condition. Select alarm state/value and determine which alarms cause automatic dial-out.

.2 Critical alarm or change-of-state: Display message, stored on disk for review and sort, or print.

.3 Print on line changeable message, up to 60 characters minimum in length, for each alarm point specified.

.4 Display alarm reports on video. Display multiple alarms in order of occurrence.

.5 Define time delay for equipment start-up or shutdown.

.6 Allow unique routing of specific alarms.

.7 Operator specifies if alarm requires acknowledgement.

.8 Continue to indicate unacknowledged alarms after return to normal.

.9 Alarm notification:

.1 Automatic print.

.2 Display indicating alarm condition.

.3 Selectable audible alarm indication.

.7 Event Processing: Automatically initiate commands, user defined messages, take specific control actions or change control strategy and application programs resulting from event condition. Event condition may be value crossing operator defined limit, change-of-state, specified state, or alarm occurrence or return to normal.

.8 Automatic Restart: Automatically restart field equipment on restoration of power. Provide time delay between individual equipment restart and time of day start/stop. Sequence restart to avoid damage to equipment and systems. Sequence restart to minimize electrical demand.

.9 Messages:

.1 Automatically display or print user-defined message subsequent to occurrence of selected events.

.2 Compose, change, or delete any message.

.3 Display or log any message at any time.

.4 Assign any message to any event.

.10 Reports:

.1 Manually requested with time and date.

.2 Long term data archiving to hard disk.

.3 Automatic directives to download to transportable media such as floppy diskettes for storage.

.4 Data selection methods to include data base search and manipulation.

.5 Data extraction with mathematical manipulation.

.6 Allow development of XY curve plotting, tabular reports (both statistical and summary), and multi-point timed based plots with not less than four (4) variables displayed.

.7 Generating reports either normally at operator direction, or automatically under work station direction.

.8 Reports may either manually displayed or printed, or may be printed automatically on daily, weekly, monthly, yearly or scheduled basis.

.9 Include capability for statistical data manipulation and extraction.

.10 Provide capability to generate four types of reports: Statistical detail reports, summary reports, trend graphic plots, x-y graphic plots.

.11 Parameter Save/Restore: Store most current operating system, parameter changes, and modifications on disk or diskette.

.12 Data Collection:

.1 Automatically collect and store in disk files.

.2 Daily electrical energy consumption, peak demand, and time of peak demand for up to 30 electrical meters over 2 year period.

.3 Daily consumption for up to 30 meters over a 2 year period.

.4 Daily billable electrical energy consumption and time for up to 1024 zones over a 10 year period.

.5 Provide archiving of stored data for use with system supplied custom reports.

.13 Graphic Display: Support graphic development on work station with software features:

.1 Page linking.

.2 Generate, store, and retrieve library symbols.

.3 Single or double height characters.

.4 Sixty (60) dynamic points of data per graphic page.

.5 Pixel level resolution.

.6 Animated graphics for discrete points.

.7 Analog bar graphs.

.8 Display real time value of each input or output line diagram fashion.

.14 Maintenance Management:

.1 Run time monitoring, per point.

.2 Maintenance scheduling targets with automatic annunciation, scheduling and shutdown.

.3 Equipment safety targets.

.4 Display of maintenance material and estimated labour.

.5 Target point reset, per point.

.15 Advisories:

.1 Summary which contains status of points in locked out condition.

.2 Continuous operational or not operational report of interrogation of system hardware and programmable control units for failure.

.3 Report of power failure detection, time and date.

.4 Report of communication failure with operator device, field interface unit, point, programmable control unit.

2.5 Programming Application Features

.1 Trend Point:

.1 Sample points, real or computed, with each point capable of collecting samples at intervals specified in minutes, hours, days, or month.

.2 Output trend logs as line graphs or bar graphs. Output graphic on terminal, with each point for line and bar graphs designated with a unique pattern and colour, vertical scale either actual values or percent of range, and horizontal scale time base. Print trend logs up to 12 columns of one point/column.

.2 Alarm Messages:

.1 Allow definition messages.

.2 Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totalized point's warning limit, hardware elements advisories.

.3 Output assigned alarm with "message requiring acknowledgement".

.4 Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.

.3 Weekly Scheduling:

.1 Automatically initiate equipment or system commands, based on preselected time schedule for points specified.

.2 Provide program times for each day of week, per point, with one minute resolution.

.3 Automatically generate alarm output for points not responding to command.

.4 Provide for holidays.

.5 Operator commands:

.1 System logs and summaries.

.2 Start of stop point.

.3 Lock or unlock control or alarm input.

.4 Add, delete, or modify analog limits and differentials.

.5 Adjust point operation position.

.6 Change point operational mode.

.7 Open or close point.

.8 Enable/disable, lock/unlock, or execute interlock sequence or computation profile.

.9 Begin or end point totalization.

.10 Modify totalization values and limits.

.11 Access or secure point.

.12 Begin or end HVAC or load control system.

.13 Modify load parameter.

.14 Modify demand limiting and duty cycle targets.

.6 Output summary: Listing of programmed function points, associated program times, and respective day of week programmed points by software groups or time of day.

.4 Interlocking:

.1 Permit events to occur, based on changing condition of one or more associated master points.

.2 Binary contact, high/low limit of analog point or computed point are capable of being utilized as master. Same master may monitor or command multiple slaves.

.3 Operator commands:

.1 Define single master/multiple master interlock process.

.2 Define logic interlock process.

.3 Lock/unlock program.

.4 Enable/disable interlock process.

.5 Execute terminate interlock process.

.6 Request interlock type summary.

Part 3 Execution

3.1 Examination

.1 Section 21 05 00: Verification of existing conditions before starting work.

.2 Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.2 Installation

.1 Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

.2 Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation.

.3 Provide with 120v AC, 15 amp dedicated emergency power circuit to each programmable control unit.

.4 Provide electrical wiring to Section 26 05 19 and Section 26 05 80. Electrical material and installation to appropriate requirements of Division 26.

3.3 Manufacturer's Field Services

.1 Section 21 05 00: Prepare and start systems.

.2 Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

.3 Provide service engineer to instruct The City's representative in operation of systems plant and equipment. Provide sign off sheets; refer to section 21 05 00.

.4 Provide basic operator training for the operators on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include the required number of hours of dedicated instructor time to ensure the user is satisfied and sufficiently trained. Provide training on site.

3.4 Demonstration And Instructions

.1 Section 21 05 00: Demonstrating installed work.

.2 Demonstrate complete and operating system to The City.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Sequence of operation:

- .1 General
- .2 Sump Pit Monitoring
- .3 Crawlspace Exhaust
- .4 Crawlspace Conditioning

1.2 Related Sections

.1 Section 25 30 00 - Instruments And Control Elements.

.2 Section 25 50 02 - Digital Control Equipment.

.3 Section 26 05 80 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 System Description

.1 This section defines the manner in which controls function.

.2 Requirements for each type of control system operation are specified.

.3 Equipment, devices, and system components required for control systems are specified in other Sections.

1.4 Submittals For Review

.1 Section 21 05 00: Procedures for submittals.

.2 Shop Drawings: Indicate mechanical system controlled and control system components.

- .1 Label with settings, adjustable range of control and limits. Include written description of control sequence.
- .2 Include flow diagrams for each control system, graphically depicting control logic.
- .3 Include draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.

1.5 Submittals At Project Closeout

.1 Section 21 05 00: Submittals for project closeout.

.2 Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

Part 2 Products

2.1 Not Used

.1 Not Used

Part 3 Execution

3.1 General

.1 All controls shall be connected to the Johnson Controls Building Management System for the site located in the main building via BACnet network connection.

.2 Crawlspace controls shall utilize outdoor ambient temperature, humidity and enthalpy conditions from the main building system via network connection where referenced in the sequence of operation.

3.2 Sump Pit Monitoring

.1 Packaged Sump Pumps complete with:

.1 Control panel with alternator, alarm outputs.

.2 DDC to monitor:

.1 Sump pump controllers for faults.

.2 High water level as sensed by independent level switch, connect to DDC.

	Hardware Points				Software Points						
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Sump Pit 1 High Level	x								x	x	x
Sump Pit 2 High Level	x								x	x	x
Sump Pit 3 High Level	x								x	x	x
Sump Pit 1 Pump Status			x						x		x
Sump Pit 2 Pump Status			x						x		x
Sump Pit 3 Pump Status			x						x		x
Sump Pit 1 Pump Failure			x							x	x
Sump Pit 2 Pump Failure			x							x	x
Sump Pit 3 Pump Failure			x							x	x
Totals	**3**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**6**	**6**	**9**

Total Hardware (9) **Total Software (12)**

3.3 Crawlspace Exhaust (EF-1)

.1 Run Conditions:

.1 The crawlspace exhaust fan shall operate continuously when Desiccant Dehumidification unit (DDH-1) is not operating.

.2 Exhaust fan shall be disabled from operation when outdoor air enthalpy is higher than the crawlspace enthalpy or when the outdoor air temperature is above 10C.

.2 Fan Runtimes:

.1 The fans shall have a user definable (adj.) minimum runtime.

.3 Exhaust and Intake Air Dampers:

.1 The exhaust and intake air dampers shall open anytime the fans are called to operate and shall close anytime the fans stop. The dampers shall close 30 sec (adj.) after the fans stop.

.4 Fan Status:

.1 The controller shall monitor amperage and status of the exhaust fan.

	Hardware Points				Software Points						
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Crawlspace Temperature 1	x								X		X
Crawlspace Temperature 2	x								X		X
Crawlspace Temperature 3	x								X		X
Crawlspace Temperature 4	x								X		X
Crawlspace Humidity 1	x								X		X
Crawlspace Humidity 2	x								X		X
Crawlspace Humidity 3	x								X		X
Crawlspace Humidity 4	x								X		X
Exhaust Fan Start/Stop				x					X		X
Exhaust Fan Fault			x							X	X
Exhaust Fan Status	x		x						X		X
Exhaust Fan Failure										X	X
Exhaust Fan in Hand										X	X
Crawlspace Humidity Setpoint					x				X		X
Crawlspace Temperature Setpoint					x				x		X
High Crawlspace Humidity										X	X
High Crawlspace Temperature										X	X
Low Crawlspace Temperature										X	X
Intake Damper				x					X		X
Intake Damper Status			x						X	X	X
Exhaust Damper				x					X		X
Exhaust Damper status			x						x	X	X
Totals	**9**	**0**	**4**	**3**	**2**	**0**	**0**	**0**	**16**	**8**	**22**

Total Hardware (18) **Total Software (24)**

3.4 Crawlspace Conditioning (F-1, F-2, DDH-1, CU-1)

.1 Run Conditions:

.1 While the ice surface is in operation, circulation fans F-1 and F-2 shall operate continuously to circulate air within the crawlspace and Desiccant Dehumidification Unit (DDH-1) shall be enabled to operate to condition crawlspace air.

.2 DDH-1 shall operate continuously to maintain humidity setpoint via internal controls. Control shall be connected to building DDC to communicate crawlspace humidity and temperature conditions. Exhaust and return dampers in the

ductwork shall be opened when DDH-1 is called to operate. D/X system (CU-1) shall operate to reduce process air temperature discharged back into crawlspace as sensed by duct mounted sensor, setpoint shall be 50F.

.3 Operational Note: Crawlspace shall be pre-conditioned for 5 days prior to installation of ice surface to reduce crawlspace humidity to suitable levels, 50 F, 50% RH. A dewpoint of 0C, (32F) is targeted to mitigate condensation in the crawlspace while ice surface is operational.

.2 Fan Runtimes:

.1 DDH-1 shall have a user definable (adj.) minimum runtime.

.3 Unit Status:

.1 The controller shall monitor status of DDH-1.

.4 For each fan coil provide the following points:

	Hardware Points				Software Points						
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Loop**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
F-1 Start/Stop			x						x		x
F-1 Status			x						x		x
F-2 Start/Stop			x						x		x
F-2 Status			x						x		x
DDH-1 Start/Stop			x						x		x
DDH-1 Status			x						x		x
DDH-1 Process Air exhaust Damper				x					x		x
DDH-1 Process Air return Dampers				x					x		x
DDH-1 Process exhaust Damper Status			x						x		x
DDH-1 Process return Damper Status			x						x		x
DDH-1 Discharge Temperature	x								x		x
DDH-1 Failure										x	x
DDH-1 in Hand										x	x
CU-1 Start/Stop				x					x		x
CU-1 Status			x						x		x
CU-1 Failure										x	x
CU-1 in Hand										x	x
Totals	**1**	**0**	**9**	**3**	**0**	**0**	**0**	**0**	**13**	**4**	**18**

Total Hardware (13) **Total Software (17)**

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Electrical demolition.

1.2 Related Sections

.1 Section 02 41 19 - Selective Demolition.

Part 2 Products

2.1 Materials And Equipment

.1 Materials and equipment for patching and extending work: As specified in individual Sections.

Part 3 Execution

3.1 Examination

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Verify field measurements and circuiting arrangements are as shown on Drawings.

.3 Verify that abandoned wiring and equipment serve only abandoned facilities.

.4 Electrical drawings are based on existing record documents and/or casual field observations. Coordinate full extent of demolition work with all disciplines. Coordinate on site with all trades prior to commencement of demolition.

.5 Report discrepancies to the Contract Administrator, and The City before disturbing the existing installation.

.6 Beginning of demolition means installer accepts existing conditions.

3.2 Preparation

.1 Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

.2 Reroute/extend/re-feed existing electrical as required to maintain existing systems not indicated to be removed.

.3 Coordinate utility service outages with Utility Company.

.4 Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

.5 Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switch overs and connections. Obtain permission from the The City at least forty eight (48) hours before partially or completely disabling system. Disable system at a time suitable to the The City only. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area as required.

.6 Existing Fire Alarm System: Maintain existing system in service. Disable existing system only to make switch overs and modifications. Notify The City and local fire service and at

least forty eight (48) hours before partially or completely disabling system. Disable system at a time suitable to the The City only. Minimize outage duration and make all arrangements for fire watch during outage. Make temporary connections and relocations to maintain service in areas adjacent to and in the work area as required. Where existing devices are covered to minimize dust infiltration during construction, ensure all dust caps are removed during non-construction periods.

.7 Existing Distribution: Maintain feeds to existing panels. Disable existing panels only to make switch overs and modifications. Notify The City at least twenty-four (24) hours before partially or completely disabling system. Disable system at a time suitable to the The City only. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area as required.

3.3 Demolition And Extension Of Existing Electrical Work

.1 Demolish and extend existing electrical work to this Section and as indicated.

.2 The construction documents indicate major items of equipment, fixtures and devices, that exist and may not indicate every item or supporting wiring and conduit to be removed and/or relocated.

.3 Carefully examine the site and construction documents to verify the extent of work defined in the construction documents. Be responsible for determining which existing equipment and/or devices are to be removed and/or relocated.

.4 Remove, relocate, and extend existing installations to accommodate new construction including all existing equipment and/or devices indicated within the construction documents.

.5 Where existing equipment and/or devices are to be temporarily relocated, coordinate the required structure to support the equipment.

.6 Remove abandoned wiring to source of supply.

.7 Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

.8 Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

.9 Disconnect and remove abandoned panelboards and distribution equipment.

.10 Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

.11 Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

.12 Repair adjacent construction and finishes damaged during demolition and extension work.

.13 Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

.14 Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 Cleaning And Repair

.1 Clean and repair existing materials and equipment which remain or are to be reused.

.2 Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, broken electrical parts and lenses.

3.5 Finishes

.1 Clean, prime and paint exposed wiring, conduit, junction and pull boxes, hangers, racking, and fasteners to prevent rusting and to match existing finishes where applicable.

END OF SECTION

Part 1 General

1.1 Related Sections

.1 Division 0 – Bidding & Contract Requirements

.2 General Requirements

.3 All Electrical Drawings and Division 25, 26, 27, 28 Series Specification Sections.

1.2 References

.1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.

.2 CAN3-C235-83 (R2015) - Preferred Voltage Levels for AC Systems, 0 to 50 000 V.

.3 CSA (Canadian Standards Association).

.4 ULC (Underwriters' Laboratories of Canada).

.5 ASTM E-814, - Fire Tests of Penetration Fire Stops.

.6 ANSI/ UL1479 - Fire Tests of Through Penetration Firestops

1.3 REGULATORY REQUIREMENTS

.1 Conform to CSA-C22.1-18.

.2 Comply with all CSA Electrical Bulletins in force at time of tender submission.

.3 Comply with all provincial by-laws, ordinances, codes, rulings, and other requirements.

.4 Comply with requirements of the electrical supply authority and the local inspection authority.

.5 Products: Listed and classified by CSA, or ULC and as suitable for the purpose specified and indicated. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the appropriate Inspection Departments.

1.4 Definitions

.1 The following are definitions of terms and expressions used in the specification:

.1 Contract Administrator: Electrical Engineering Contract Administrator: Epp Siepman Engineering Inc.

.2 Inspection Authority: agent of any authority having jurisdiction over construction standards associated with any part of electrical work on site.

.3 Supply Authority: electrical power utility company responsible for delivery of electrical power to project.

.4 Electrical Code: Canadian Electrical Code or Local Code in effect at project location.

.5 Indicated: as shown on contract drawings or noted in Contract Documents.

.6 Install: To remove from site storage, move or transport to intended location, install in position, connect to utilities, repair site caused damage, and make ready for use.

.7 Supply: To acquire or purchase, ship or transport to the site, unload, remove packaging to permit inspection for damage, re-package, replace damaged items, and safely store on-site.

.8 Provide: Wherever the term "provide" is used in relationship to equipment, conduit and other materials specified for the work, it means "supply, install, connect and leave in working order all materials and necessary wiring, supports, access panels, etc., as necessary for equipment indicated." Wherever the terms "provide" is used in connection with services such as testing, load balancing, start-up, preparation of drawings for any part of the work, it means procure, prepare, supervise, take responsibility for, and pay for these services.

.9 Typical: A representative characteristic that is standard for all installations whether individually noted or not throughout the documents. "Typical" applies to each individual or combined installation except where specifically noted or otherwise indicated that the application is non-typical.

.10 Exposed: Any work not concealed in wall, shaft, or ceiling cavities or spaces. Work behind doors, in closets or cupboards or under counters is considered exposed.

.11 New: Produced from new materials.

.12 Renewed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.

.13 Defective: A condition determined exclusively by the Contract Administrator.

1.5 Permits & Fees

.1 Submit all quantities of drawings and specifications necessary for examination and approval to Electrical Permit Department and Electrical Supply Authority prior to commencement of work.

.2 Obtain and pay for all permits necessary for the electrical installation.

1.6 Inspection

.1 Furnish a Certificate of Acceptance from the Inspection Authorities on completion of work. Copies of Certificate shall be included in Maintenance Manuals.

.2 Certificate of Inspection and Approval shall be submitted before final payment may be considered to be due.

.3 During the course of the project construction, the Contract Administrator will carry out periodic site reviews and prepare a deficiency list for remedial action by the Electrical Subcontractor. When requested, the Electrical Contractor shall respond in writing to the Contract Administrator, stating corrective action and completion date for each item listed as deficient. This response shall be in the hands of the Contract Administrator within three working days of receipt of the Site Review Report.

1.7 Product Changes & Substitutions

.1 Change in Product/Products: Submit request for substitution or alternative in accordance with this Section, the Instructions to Bidders, and Division 01 Product Exchange Procedures Division 01 Substitutions Sections. In case of a discrepancy between this section and Division 00 and Divisions 01, the more stringent requirements shall apply.

.2 The Instructions to Bidders specify time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this section.

.3 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

.4 Any substituted item submitted for consideration must not exceed the available space limitations, and all additional costs for mechanical, electrical, structural and architectural revisions required to incorporate the substituted material shall be the responsibility of the

Electrical Division. Review maximum dimensions and weights when provided in the specification and schedules, and where not specified review the drawings for space limitations.

.5 A request constitutes a representation that the Bidder:

.1 Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.

.2 Will provide the same warranty for the Substitution as for the specified Product.

.3 Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to The City.

.4 Waives claims for additional costs or time extension which may subsequently become apparent.

.5 Will reimburse The City and Contract Administrator for review or redesign services associated with re-approval by authorities.

.6 Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

1.8 Submittals For Review

.1 Refer to Division 01.

.2 Progress Payment Application Template

.1 Prior to the first application for payment, submit for review a draft progress application template.

.2 Progress Application shall contain separate line items for the following systems:

.1 Site Services

.2 Distribution Equipment including Panels, Distribution Panels, Transformers, etc.

.3 Lighting

.4 Lighting Controls

.5 Branch Wiring, Conduit, Raceway, Boxes

.6 Fire Alarm

.7 Close Out (As-Builts, O&Ms)

.3 Progress for each system shall break out labor and materials separately.

.3 Shop Drawings Administrative Requirements

.1 Shop drawings shall be submitted electronically in PDF format documents to shopdrawings@eppsiepman.com.

.2 Shop drawing documents shall be grouped by specification section. Clearly list the specification section on the front page or cover sheet of the submittal. Shop drawings related to multiple sections may not be grouped together into a single document. Documents that are groups incorrectly will be returned without being examined and shall be considered rejected.

.1 Each drawing shall include the name of project as found on the drawings or specifications, the equipment supplier and the specification section that the equipment is specified under.

.3 Submit to Contract Administrator submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an

extension of Contract Time and no claim for extension by reason of such default will be allowed.

.4 Work affected by submittal shall not proceed until review is complete.

.5 Present Shop Drawings, product data, samples and mock-ups in SI Metric and/or Imperial inch-pound units, to match the units used in the schedules.

.4 Shop Drawings and Product Data

.1 Submit shop drawings and product data for review by the Contract Administrator. All drawings shall be in English and metric dimensions or in imperial where indicated. Manufacture of equipment shall not commence until shop drawings have been reviewed.

.2 Material submitted for review shall be marked up bear the Contractor's and where applicable the Utility's reviewed stamp.

.3 Shop drawings shall be reviewed by the electrical contractor, general contractor, and where applicable the Utility prior to submittal to Contract Administrator, confirming that they meet all the design requirements. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.

.4 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.

.5 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.6 Where applicable, include wiring, single line and schematic diagrams.

.7 Include wiring drawings or diagrams showing inter-connection with work of other sections.

.5 Provide scaled drawings showing layout of all electrical equipment and coordination of same with mechanical equipment in all electrical, electrical/mechanical and voice data rooms.

.6 Submit samples in accordance with General Conditions. Samples shall be forwarded to the Contract Administrator's office and returned. Approved samples will be retained until after tender closing, then all samples will be returned except for the sample submitted by the Manufacturer who has been listed by the successful Contractor in the tender documents. This sample will be used for comparison with the actual production run of successful manufacturer.

.7 Submit shop drawings of service entrance equipment to utilities.

1.9 Closeout Submittals

.1 Refer to Division 01.

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

.3 Four (4) weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, one (1) draft copy of operating and maintenance manuals in Canadian English.

.4 Copy will be returned with Contract Administrator's comments.

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

.6 Two (2) weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, three (3) final copies of operating and maintenance manuals in Canadian English.

.7 Summary audit documents associated with requirements for LEED classification documentation.

.8 Maintenance Data:

.1 Provide operation and maintenance data for incorporation into Maintenance Manuals.

.2 Include details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

.3 Include technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.

.4 Include all warranty information.

.5 Submit Maintenance Manuals to the Contract Administrator for review. Manuals that are incomplete shall be returned to the Electrical Sub-Contractor for completion. Completed manuals shall be submitted, to the satisfaction of the Contract Administrator, before final payment may be considered to be due.

.6 Format

.1 Refer also to Section 01 78 10 for formats for manuals. Where there is a discrepancy with this section, follow the requirements of 01 78 10.

.2 Organize data in the form of an instructional manual.

.3 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 8.5 x 11 inch (219 x 279 mm) with spine and face pockets.

.4 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

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

.6 Arrange content by systems under Section numbers and sequence of Table of Contents.

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

.8 Text: Manufacturer's printed data, or typewritten data.

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

.7 Contents

.1 Refer also to Section 01 78 10 for formats for contents. Where there is a discrepancy with this section, follow the requirements of 01 78 10.

.2 Table of Contents: Provide:

.1 Title of project.

.2 Date of submission.

.3 Names, addresses, and telephone numbers of Contract Administrator and Contractor with name of responsible parties.

.4 Schedule of products and systems, indexed to content of volume.

.3 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.4 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.

.5 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control, wiring, and schematic diagrams and performance curves.

.6 Include Systems Certifications where applicable.

.7 Include manufacturer specific warranties where applicable.

.8 Include a list of maintenance materials provided in each related section.

.9 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including code compliance certificate, life safety systems performance certificate.

.10 Training: Record of owner’s representative training as specified.

.9 Maintenance Materials:

.1 Provide maintenance materials as specified. Include a list of the maintenance materials in each related section of the operation and maintenance data.

.2 Turn materials over to The City in an orderly fashion upon completion of installation.

.10 Record Documentation:

.1 Prior to Substantial Performance of the Work, electronically transfer the marked-up information from the as-built documents, as follows:

.1 Drawings: Scan the full-sized field-verified as-built drawing set and save to PDF format. Scans shall be in colour and with good resolution to ensure drawings and markups are legible.

.2 Specifications: Adobe Acrobat (PDF).

.2 Mark revised documents as "RECORD DOCUMENTS". Include all revisions.

.3 Submit completed record documents to Contract Administrator on a CD, DVD, or by electronic transfer.

.4 Project record documents shall comprise a complete and accurate record of the actual electrical installation. Record drawings that are inaccurate or incomplete shall be returned to the contractor for correction and completion.

.5 Record drawings shall contain a stamp bearing the words “Record Drawing” or “As-Built Drawing”, the electrical contractor’s company name, date, and the contractor’s signature.

.6 The consultants will recommend a suitable deficiency holdback until accurate and complete record drawings have been submitted in acceptable form.

.7 Indicate on record drawings, location of all buried services. This information is to be certified correct by Contract Administrator before backfilling commences.

.8 Record actual size and location of all cables including depth of cables where buried.

.9 Contractor to take all schedules/details from specification and put onto additional drawing sheets for Record Drawings.

1.10 Examination

.1 Prior to submitting a tender, examine the site and local conditions which will affect the work. Refer to the Architectural, Mechanical and Structural drawings, schedules and specifications for construction details to be certain that the electrical work can be satisfactorily carried out as specified. Claims for extra payments resulting from conditions which could reasonably be foreseen during an examination of the documents and/or site, will not be recognized.

.2 Ensure that all equipment designated as “Existing to Remain” or “Existing to be Relocated” is suitable for its intended re-use, including panelboards and circuits. Report any discrepancies to the Contract Administrator before tender close.

.3 Refer to General Conditions for instructions regarding a prearranged site visit during the tender period.

.4 Notify Contract Administrator of any discrepancies, omissions, etc., prior to the awarding of the contract, otherwise the Electrical Contractor shall perform the work as directed at no additional cost to the The City.

1.11 MANITOBA HYDRO POWER SMART

.1 Electrical contractor shall make application on behalf of the owner for the Manitoba Hydro Power Smart Incentive for all available rebates under the Commercial Lighting Program.

.2 Application shall be made and acceptance provided by MB Hydro prior to commencement of demolition.

.3 Electrical Contractor shall gather all information as required to complete the application.

.4 Electrical Contractor shall provide updates to the owner regarding status of the application and expected rebates.

Part 2 Products

2.1 Materials And Equipment

.1 Provide labour, materials, transportation, equipment and facilities, etc., required for the complete electrical installation as indicated or implied on the drawings and specifications.

.2 Electrical equipment shall be new and of type and quality specified.

.3 Request for approval of material, as equal, shall conform to the specification.

.4 Equivalent materials and equipment

.1 Bidders shall submit a tender based on the specified materials and equipment only.

.2 Bidders may submit a tender based on equivalent materials and equipment only if such items have been approved as equals by the Contract Administrator.

.3 Bidders may submit, with their tender, an alternate price based on alternate materials and equipment only if such items have been approved as alternates by the Contract Administrator.

.4 Submissions for equals or alternates shall be received by the Contract Administrator, ten (10) working days prior to tender closing. Submissions shall include sufficient manufacturer’s data to clearly show equivalency, as well as an itemized list of equal or alternate items, the items for which they were submitted and a space for the Contract Administrator to indicate “approved equal”, “approved alternate”, or “not approved”. Submittal list will be returned or may be picked up at the Contract Administrator’s office. Where submissions are not

returned by the Contract Administrator before tender closing or are not received by the Contract Administrator ten (10) working days before close of tender, they are considered not approved.

.5 All submissions shall include the following phrase “We have reviewed all contract documents, contract drawings and specifications relating to the equipment presented herein” and shall bear the name and signature of the manufacturer or their agent.

.6 General emissions evaluation. Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario. The default scenario is the private office scenario. The manufacturer’s or third-party certification must state the exposure scenario used to determine compliance. Claims of compliance for wet-applied products must state the amount applied in mass per surface area. Manufacturers’ claims of compliance with the above requirements must also state the range of total VOCs after 14 days (336 hours), measured as specified in the CDPH Standard Method v1.1:

.1 0.5 mg/m3 or less;

.2 between 0.5 and 5.0 mg/m3; or

.3 5.0 mg/m3 or more.

.7 Additional VOC content requirements for wet-applied products. In addition to meeting the general requirements for VOC emissions (above), on-site wet-applied products must not contain excessive levels of VOCs, for the health of the installers and other trades workers who are exposed to these products. To demonstrate compliance, a product or layer must meet the following requirements, as applicable. Disclosure of VOC content must be made by the manufacturer. Any testing must follow the test method specified in the applicable regulation.

.8 All paints and coatings wet-applied on site must meet the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.

.9 All adhesives and sealants wet-applied on site must meet the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications, as analyzed by the methods specified in Rule 1168. The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to consumer product VOC regulations.

2.2 Voltage Ratings

.1 Operating voltages: to CAN3-C235-83(R2015).

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment shall operate in extreme operating conditions established in above standard without damage to equipment.

2.3 Finishes

.1 Finish outdoor electrical equipment such as parking lot panels, to match light standards.

.2 Paint indoor switchgear light grey to EEMAC-2Y-1.

.3 Paint indoor distribution enclosure trims light grey to EEMAC-2Y-1. Distribution tub shall be galvanized.

.4 Paint outdoor electrical equipment enclosures with two (2) coats of U.V. resistant Urethane Enamel to minimum 1.5 mil dry coat thickness. Colour shall be “equipment green” to EEMAC 2Y-1.

.5 Clean and touch up surfaces of shop-painted equipment, scratched or marred during shipment or installation, to match original paint.

.6 Clean, prime and paint exposed wiring, conduit, junction and pull boxes, hangers, racking, and fasteners to prevent rusting and to match surrounding finishes where applicable.

2.4 Labels And Warning Signs

.1 Manufacturer’s nameplates and CSA labels shall be visible and legible after equipment is installed.

.2 Provide warning signs on equipment, as required, to meet the requirements of the Inspection Authorities, including indication of multiple power sources.

.3 Provide quantity as required of buried cable signs reading “Buried Cable” and “Buried High Voltage Cable”. Signs shall be installed at building structure/equipment, at locations as directed on site and as per Canadian Electrical Code.

2.5 Protection

.1 Guards

.1 Provide guards for all electrical equipment and devices in gymnasium and other areas subject to damage.

.2 Sprinkler Proof Equipment

.1 All surface mounted electrical equipment located in sprinklered areas shall be sprinkler proof and shall be provided with suitable hoods and shields.

.2 Entrance of conduits into the top of surface mount electrical panels/cabinets/distributions and motor control centers shall utilize O-rings and watertight connectors.

.3 All recessed mounted branch circuit panels and distribution panels shall be provided with a Type 2 enclosure.

.3 Construction

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark live part “LIVE ( ) VOLTS”, with appropriate voltage.

.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision.

2.6 Spare Parts And Maintenance Materials

.1 Assemble spare parts as specified.

.2 Include the following:

.1 Part number.

.2 Identification of equipment or system for which parts are applicable.

.3 Installation instructions as applicable.

.3 Provide a written list complete with The City’s signature assuring that spare parts have been received by the The City.

2.7 Access Doors

.1 Access doors shall be minimum #12 gauge prime coat painted bonderized steel. Each shall be complete with a heavy flush frame and anchor, concealed hinges, positive locking screwdriver lock, and mounting and finishing provisions to suit the finish material for which they are supplied. Access doors in fire rated ceilings, walls, partitions, structures, etc. shall be ULC. listed and labeled and of a rating to maintain the fire separation integrity.

.2 Where access doors are located in surfaces where special finishes are required, they shall be of a recessed door type capable of accepting the finish in which they are to be installed so as to maintain the final building surface appearance throughout.

.3 Supply access doors in inaccessible construction shall give access to all concealed junction boxes, pullboxes, conductor joints and other similar electrical work which may need maintenance or repair.

.4 Before commencing installation of electrical work, submit to the Architect for approval, a list of required access doors showing the exact sizes and locations of such access doors. Locate access doors in walls and partitions to the Architect's approval, and arrange electrical work to suit. Access doors shall be, wherever possible, of a standard size for all applications. Confirm exact dimensions with the Architect, prior to ordering.

.5 Access doors will be installed by the Division responsible for the particular type of construction in which access doors are required. Supply the access doors to the Division installing same at the proper time to avoid construction delays.

Part 3 Execution

3.1 Coordination With Other Trades

.1 Refer to Mechanical, Structural, Architectural and Interior Design drawings and specifications for additional electrical work in connection with other Divisions. Where such work is included in other sections of the specifications, provide equipment, conduit, wiring, etc. (in accordance with the approved manufacturer's shop drawings), as required, for operation of the specified equipment.

.2 Schedule execution of electrical work with associated work specified in other Divisions.

.3 Coordinate electrical work with work of other trades to avoid conflicts with pipes, air ducts or other equipment. Provide additional supports, wiring, etc., to relocate electrical equipment, as required, where structural members, air ducts, piping or other equipment interferes with the electrical installation.

.4 Prior to installation provide scaled drawings of all mechanical/electrical rooms and communication rooms showing layout of all equipment (mechanical and electrical) for Contract Administrator review.

3.2 Quality Assurance

.1 Do complete installations in accordance with CSA C22.1-18.

.2 While not identified and specified by number in this Division, comply with CSA Electrical bulletins in force at time of tender submission. Comply with the requirements of all Provincial and local laws, rules, ordinances and codes.

.3 Electrical installations shall comply with all requirements of the electrical supply authority and the inspection authority.

.4 Electrical installation shall be in accordance with the applicable versions of the Canadian Electrical Code, Provincial and other codes, rules and regulations. Supply material and

labour required to meet the requirements of these codes, rules and regulations even though the work in not shown on the drawings or mentioned in the specifications. Where the electrical installation calls for better quality materials or construction than the minimum requirements of these codes, rules and regulations, the electrical installation shall be as shown on the drawings and as specified.

3.3 Workmanship

.1 Install equipment, conduit and cables in a workmanlike manner to present a neat appearance to the satisfaction of the Contract Administrator. Install conduit and cable runs parallel and perpendicular to building lines in chases, behind furring or above ceilings, where such concealment is possible. In areas where systems are to be exposed, install neatly and group in a tidy appearance.

.2 Install equipment/junction boxes and apparatus requiring maintenance, adjustment or eventual replacement, with adequate clearances and accessibility for same.

.3 Provide for all requirements shown on shop drawings or manufacturer's installation instructions.

.4 Work deemed by the Contract Administrator to be unsatisfactory shall be replaced at no additional cost.

3.4 Delivery Storage And Handling

.1 Deliver all materials to site in an orderly fashion.

.2 Store all materials in a clean and dry place, secure from vandalism or theft. All materials shall be left in shipping containers until required for use.

.3 Provide additional protection such as tarps, padding, wood skids, etc., as required to ensure protection of equipment and as directed by the Architect.

3.5 Excavation And Backfilling

.1 Excavate and backfill as required for underground electrical services as indicated. Provide protective materials around and over services and be present at all times during excavation and backfilling to supervise work. Backfilling shall restore the excavated area to the original condition and shall include sodding where required.

.2 Work shall be in accordance with the current CSA Bulletin.

.3 Include all costs for excavation and backfilling, for any underground electrical installation, unless otherwise indicated.

.4 Work shall be arranged in such a manner that will not interfere with regular pedestrian or vehicular traffic patterns.

.5 Provide trenching, cable installations and backfill promptly. Open trenches shall be barricaded in an appropriate manner.

.6 Cables required to cross under roadways, paved areas, sidewalks, etc. shall be installed in PVC conduits pushed under such areas.

.7 Six (6") of sand shall be provided surrounding installed cables and 2" x 4" treated plank installed 6" above the cables. Install cable marker tape in all trenches, minimum 12" above cables. The remainder of the trench shall be backfilled with granular base course. All backfill material shall be thoroughly tamped and compacted to at least 90% of maximum density at optimum moisture. The ground shall be left free from ruts and rough spots. In any asphalt areas, backfill shall be granular material only.

.8 All sodded areas disturbed or damaged during trenching and backfilling shall be repaired with manured soil mix and resodded. Make all repairs to damaged asphalt and/or concrete surfaces to match existing.

.9 Care shall be taken when excavating near existing services. Existing trees and shrubbery in work area shall be protected from damage.

.10 Install buried cable signs as per CEC and Manitoba Electrical addendums.

3.6 Conduit Sleeves And Holes

.1 Install conduit, and sleeves, prior to pouring of concrete. Sleeves through concrete shall be sized for free passage of conduit.

.2 Holes through exterior walls and roof shall be flashed and made weatherproof.

.3 Make necessary arrangements for cutting of chases, drilling of holes and other structural work required to install electrical conduits, cables, pullboxes and outlet boxes.

.4 Install cables, conduits, and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.5 Provide a minimum of two (2) separate conduit sleeves embedded in each concrete lighting fixture base. At least one (1) unused conduit shall be for possible future extension of wiring.

.6 All conduits and cables shall be entered into the building above grade unless otherwise noted.

.7 All coring in buildings with electrical in the slab shall be scanned at contractor's expense to prevent damage.

3.7 Cutting And Patching

.1 Pay the costs of all cutting and patching required for the installation of electrical work. Payment for cutting and patching shall be made through the General Contractor.

.2 Cutting and patching required for the installation of electrical work shall be done by the particular trade whose work is involved. No cutting or patching shall be carried out by the tradesman employed on the electrical work.

.3 Obtain the approval of the Architect before arranging for any cutting. Patching shall restore the affected area to the original condition; materials and methods used for patching shall be in accordance with the requirements of the corresponding Divisions of the specification.

3.8 Device Installation

.1 Device Location

.1 Locate devices as indicated.

.2 Do not install devices back-to-back in wall.

.3 Drawings are schematic only and do not indicate all architectural or structural elements.

.4 Change location of devices at no extra cost or credit, providing distance does not exceed 10'-0" (3 m) and information is provided before installation.

.5 Locate light switches on latch side of doors.

.6 Vertically align devices of different systems when shown in close proximity to each other and occurring at different mounting heights.

.7 Coordinate mounting heights and location of all equipment with Architectural, Mechanical and Structural Drawings prior to installation of rough-in boxes.

.2 Mounting Heights

.1 Mounting height of equipment is from finished floor to centre line of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not indicated, verify with Architect before proceeding with installation.

.3 Install electrical equipment at the following heights unless indicated or directed otherwise:

Device / Equipment	Mounting Height	
Devices above counters	150mm	6”****
Receptacles:		
- General	400mm	16”
- Mechanical/Shop Areas	1000mm	40”
- Exterior	1000mm	40”
Switches, Dimmers, push buttons, Luxo bracket		
- General	1200mm	47”
- Accessible Suites	900mm	36”
Emergency Lighting Battery Banks/Remote Headers	2350mm* or 150mm**	92”* or 6”**
Fire Alarm Visual, Audible, & Combination Devices	2350mm* or 150mm**	92”* or 6”**
Fire Alarm Manual Pullstations	1200mm	47”
Branch Circuit Panelboards, Control Panels, Annunciators. Install panels taller than 1800mm (72”) with bottom no more than 100mm (4”) above floor.	2000mm*	78”*
Enclosed circuit breakers	1600mm***	60”***

*Measured to top of device/equipment

**Measured from Ceiling to top edge of device where mounting height would be lower than required specification.

***Measured to operating handle of device.

****Coordinate counter backsplash heights with architectural drawings prior to rough-in. Maintain minimum 1” clearance above backsplash height.

*****Measured above door trim to underside of device.

.1 Coordinate all mounting heights with Architectural elevations.

.2 Where installed in block or brick, mounting heights shall be as above or at bottom of nearest course.

.4 Circuiting is representational within a panel only. Circuit all electrical equipment and devices to their individually respective, intended panels.

.5 Panelboards and other equipment which are to be surface mounted shall be installed on minimum 19mm (3/4”) good one side, fir plywood mounting backboards. Treat backboards with wood preservative prior to installation and paint with primer and two (2) coats gray enamel before any equipment is mounted. Provide plywood mounted boards unless specified otherwise in other sections.

.6 Panelboards mounted on exterior concrete/block walls shall have minimum 3/4" air gap behind enclosure (to minimize condensation).

.7 All transformers, motor control centers and floor-mounted distribution panels shall be mounted on 100mm (4") concrete housekeeping pads. The Electrical Contractors shall be responsible for provision of these pads.

3.9 Fireproofing

.1 Where cables or conduits pass through block or concrete walls and floors and any fire-rated assembly, seal openings with firestopping systems that have been tested for specific fire-resistance-rated construction conditions conforming to the construction assembly type, penetrating item type, annular space requirements, and fire-rating involved in each instance.

.2 Provide products that upon curing, do not re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during and after construction.

.3 Openings within walls and floors designed to accommodate cabling systems subjected to frequent cable changes shall be provided with re-enterable products.

.4 Fire proofing of electrical cables, conduits, trays, etc, passing through fire barriers shall conform to local codes and inspection authorities.

.5 Fire stop materials shall be asbestos free and have been tested in accordance with ASTM E-814, and ULC 1479.

.6 Fire stop and smoke seals shall be done in accordance with Section 07 84 00 – Firestopping.

3.10 Load Balance

.1 Measure phase current to panelboards with normal loads operating at time of measurement. 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 Submit, at completion of work, a report listing phase and neutral currents on panelboards, transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

.4 Include load balance test results in maintenance manuals.

3.11 Testing

.1 Conduct and pay for tests including, but not limited to, the following systems:

.1 High voltage distribution equipment in accordance with relevant sections of specification.

.2 Power generation and distribution system.

.3 Circuits originating from branch distribution panels.

.4 Lighting and its control.

.5 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.6 Heating cables and mats.

.7 Systems:

.1 Fire Alarm

.8 Grounding systems.

.2 Insulation Resistance Testing

.1 Hi-pot all H.V. cable and equipment over 600 volts, to manufacturer's specifications.

.2 Megger circuits, feeders and equipment up to 350V with a 500V instrument.

.3 Megger 350-600V circuits, feeders and equipment with a 1000V instrument.

.4 Check resistance to ground before energizing.

.3 Furnish Manufacturer's Certificate or letter confirming that entire installation, as it pertains to each system, has been installed to manufacturer's instructions. Submit letter in accordance with this section.

.4 Carry out tests in presence of Contract Administrator where directed.

.5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.6 Submit test results in Maintenance Manuals.

3.12 Care, Operation And Start-up

.1 Instruct the The City's operating personnel in the operation, care and maintenance of equipment. Arrangement of such instructional sessions shall be done at a time convenient to the The City.

.2 Arrange and pay for services of Manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.

.3 Provide these services for such a period, and for as many visits as necessary to put equipment into operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

3.13 Cleaning

.1 Final cleaning shall be done in accordance with the specification.

.2 Final cleaning shall include, but not be limited to, all lighting reflectors, lenses, and other lighting surfaces that have been exposed to dust and dirt throughout the course of construction.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Building wire and cable.

.2 Armoured cable.

.3 Metal clad cable.

.4 Fire rated cable.

.5 Wiring connectors and connections.

1.2 Related Sections

.1 Section 26 05 53 - Electrical Identification.

.2 Section 31 23 18 - Trenching: Trenching and backfilling for direct burial cable installation.

1.3 References

.1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.

.2 C22.2 No. 0.3-09 (R2014) - Test Methods for Electrical Wires and Cables.

.3 CSA C22.2 No. 48-15 - Non-metallic Sheathed Cable.

.4 CSA C22.2 No. 51-14 - Armoured Cables.

.5 CSA C22.2 No. 52-15 - Underground Secondary and Service Entrance Cables.

.6 CAN/CSA-C22.2 No. 65-18 - Wire Connectors.

.7 CSA C22.2 No. 75-17 - Thermoplastic-Insulated Wires and Cables.

.8 CSA C22.2 No. 123-16 - Metal Sheathed Cables.

.9 CAN C22.2 No.131-17 - Type TECK 90 Cable.

.10 CSA C22.2 No. 208-14 - Fire Alarm and Signal Cable.

.11 NECA (National Electrical Contractors Association) - National Electrical Installation Standards (NEIS).

.12 NETA (InterNational Electrical Testing Association) - ANSI/NETA ATS-2017 - Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.

.13 CSA (Canadian Standards Association).

.14 ULC (Underwriters' Laboratories of Canada).

1.4 Administrative Requirements

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

1.5 Submittals For Review

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Product Data: Provide for Fire Rated Cable.

1.6 Submittals For Information

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.

.3 Installation Data: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.7 Closeout Submittals

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Record Documentation:

.1 Record actual locations of components and circuits.

.2 Record routing of all equipment and panelboard feeders.

1.8 Quality Assurance

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.9 Regulatory Requirements

.1 Conform to CSA-C22.1.

.2 Provide products listed and classified by CSA or ULC and as suitable for the purpose specified and indicated.

1.10 Project Conditions

.1 Conductor sizes are based on copper unless indicated as aluminum or "AL".

.2 If aluminum conductor is substituted for copper conductor, size to match circuit requirements for conductor ampacity and voltage drop.

Part 2 Products

2.1 Building Wire And Cable

.1 Description: Single conductor insulated wire.

.2 Conductor: Copper unless otherwise noted.

.3 Insulation Voltage Rating: 600 volts.

.4 Insulation: Thermoplastic material rated 90 degrees C.

.5 Insulation Temperature Rating: 90 degrees C.

.6 Underground Warning Tape: 100mm (4 inch) wide plastic tape, detectable type, coloured yellow with suitable warning legend describing buried electrical lines.

2.2 Armoured Cable

.1 Description: Type ACWU90 and AC90.

.2 Conductor: Copper unless otherwise noted.

.3 Insulation Voltage Rating: 600 volts.

.4 Insulation Temperature Rating: 90 degrees C.

.5 Insulation Material: Thermoplastic.

2.3 Metal Clad Cable

.1 Description: Type TECK90.

.2 Conductor: Copper unless otherwise noted.

.3 Insulation Voltage Rating: 600 volts.

.4 Insulation Temperature Rating: 90 degrees C.

.5 Conductor Insulation Material: Cross-Linked Polyethylene (XPLE), type RW90.

.6 Armour Material: Aluminum.

.7 Armour Design: Interlocked metal tape.

.8 Outer jacket: PVC.

.9 Rating: Hazardous Location, CSA FT4

2.4 Fire Rated Cable

.1 Manufacturers:

.1 Pyrotenax; Product: System 1850.

.2 Substitutions: Not permitted.

.2 Description: Mineral Insulated

.3 Conductor: Copper

.4 Insulation Voltage Rating: 600V.

.5 Insulation: Magnesium Oxide

.6 Outer Jacket: Copper

2.5 Connectors

.1 Pressure type connectors, fixture type splicing connectors, cable clamps and lugs, as required.

Part 3 Execution

3.1 Examination

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Verify that field measurements are as indicated.

.3 Verify that interior of building has been protected from weather.

.4 Verify that mechanical work likely to damage wire and cable has been completed.

.5 Verify that raceway installation is complete and supported.

3.2 Preparation

.1 Completely and thoroughly swab raceway before installing wire.

3.3 Wiring Methods

.1 Concealed Dry Interior Locations: Use only armoured cable and building wire in raceway.

.2 Exposed Dry Interior Locations: Use only building wire in raceway.

.3 Above Accessible Ceilings: Use only armoured cable, metal clad cable, and building wire in raceway.

.4 Wet or Damp Interior Locations: Use only metal clad cable, armoured cable with jacket, and building wire in raceway.

.5 Exterior Locations: Use only building wire Type RWU90 insulation in raceway, metal clad cable, and armoured cable with jacket.

.6 Underground Installations: Use only direct burial cable, armoured cable with jacket, and metal clad cable.

.7 Use wiring methods indicated.

3.4 Installation

.1 Route wire and cable as required to meet project conditions.

.2 Install cable to the CSA-C22.1.

.3 Use solid conductor for feeders and branch circuits 10 AWG and smaller.

.4 Use stranded conductors for control circuits.

.5 Use conductor not smaller than 12 AWG for power and lighting circuits.

.6 Use conductor not smaller than 16 AWG for control circuits.

Maximum Conductor Length for 120V Branch Circuits

Breaker Size[A]	Conductor	
	Size [AWG]	Max Length [m]
15A	#12	20
	#10	35
	#8	55
	#6	90
20A	#12	15
	#10	25
	#8	40
	#6	65
	#4	110
30A	#10	15
	#8	25
	#6	45

	#4	70

.7 Pull all conductors into raceway at same time.

.8 Use suitable wire pulling lubricant for building wire 4 AWG and larger.

.9 Protect exposed cable from damage.

.10 All cable routed below grade shall enter/exit the building below grade unless noted otherwise.

.11 Support cables above accessible ceiling, using spring metal clips to support cables from structure. Do not rest cable on ceiling panels.

.12 Single conductor cables shall be installed one cable diameter apart on suspended cable tray or channel supports and shall be clamped with aluminum cable clamps. Cables shall be terminated using non-magnetic connectors and shall be watertight for top entry. Cable armour shall be grounded via an aluminum plate at the supply end and isolated via an insulating plate, at the load end of the cable. A #3/0 AWG insulated (unless otherwise noted) copper ground wire shall be installed with each set of feeder cables. Cable bending radius shall be at least twelve times the overall cable diameter and bend shall not damage or distort the outer sheath.

.13 Armoured cable shall be used for connections from conduit systems to recessed luminaires in accessible ceilings. Cable shall be of sufficient length to allow the lighting fixture to be relocated to any location within an 1800mm (6') radius. Cable shall be clamped before entering the lighting fixture and shall be clipped before entering the conduit system junction box. (Minimum requirements).

.14 Armoured cable may be used for connections from conduit systems to wiring devices in steel stud partitions and for interconnection of wiring devices within steel stud partitions. Cables shall be clipped before entering junction or outlet boxes.

.15 Fire Rated Cable shall be installed in complete unbroken lengths parallel with building lines and terminated as per manufacturer's instructions. Care shall be taken at all times to prevent the entry of moisture into the ends of the cable.

.16 Fire Rated Cable shall be surface-mounted to building surfaces with stainless steel banding or straps.

.17 Use suitable cable fittings and connectors.

.18 Neatly train and lace wiring inside boxes, equipment, and panelboards.

.19 Clean conductor surfaces before installing lugs and connectors.

.20 Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

.21 Terminate aluminum conductors with tin-plated aluminum- bodied compression connectors only. Fill with anti-oxidant compound before installing conductor.

.22 Use suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.

.23 Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

.24 Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

.25 Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

.26 Identify wire and cable to Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Bonding.

1.2 Related Sections

.1 Section 26 00 00 – Basic Electrical Materials and Methods.

1.3 References

.1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.

.2 CSA-Z32-09 Electrical Safety & Essential Electrical Systems in Health Care Facilities.

.3 IEEE 81-2012 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.

1.4 System Description

.1 Metal and underground water pipe.

.2 Metal frame of the building.

.3 Metal and underground gas piping system.

1.5 Performance Requirements

.1 Maximum Grounding System Resistance: 5 ohms.

1.6 Submittals For Review

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Product Data: Provide for grounding electrodes and connections.

1.7 Submittals For Information

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Test Reports: Indicate overall resistance to ground.

1.8 Closeout Submittals

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Record Documentation: Record actual locations of components and grounding electrodes.

.3 Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.9 Quality Assurance

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years experience.

1.10 Regulatory Requirements

.1 Products: Listed and classified by ULC and/or CSA as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Mechanical Connectors

.1 Material: Bronze.

2.2 Wire

.1 Material: Stranded copper.

.2 Grounding Electrode Conductor: Size to meet CSA-C22.1 requirements.

Part 3 Execution

3.1 Examination

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 Installation

.1 Provide bonding to meet Regulatory Requirements.

.2 Exposed conductors shall be protected from mechanical injury.

.3 Mechanical connections shall be used for bonding connections to equipment. Soldered joints shall not be permitted.

.4 Buried connections of grounding and bonding conductors shall be made using exothermic welding process.

.5 Provide bonding wire connected to both ends of flexible conduit. Neatly attach to exterior of flexible conduit.

.6 Provide separate ground conductors for all exterior pole mounted luminaires.

.7 Interface with site grounding system.

.8 Bonding connections shall be made using a star configuration. Loop connections shall be avoided.

.9 Single conductor cables with metallic armour shall be bonded at the supply end only. Provide non-metallic entry plates for load end terminations. Provide a separate bonding conductor.

.10 Provide separate bonding conductor in all non-metallic raceways.

.11 Bond together metal siding not attached to grounded structure; bond to ground.

.12 Bond together reinforcing steel and metal accessories in fountain and pool structures.

.13 Install transient suppression plate where indicated.

.14 Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

.15 Provide additional separate bonding conductor within branch circuit raceways where indicated on the drawings. Terminate each end on suitable lug, bus, or bushing.

3.3 System Grounding

.1 Install system and circuit grounding connection to neutral points of 600V and 208V systems.

.2 Grounding conductors shall be routed in or adjacent to primary conduits or cables.

3.4 Equipment Bonding

.1 Install bonding connections to typical equipment included in, but not necessarily limited to:

.1 Service equipment
.2 Distribution Panels
.3 Transformers
.4 Generators
.5 Motor Frames
.6 Motor Control Centres
.7 Starters
.8 Control Panels
.9 Building Steel Work
.10 Elevators
.11 Outdoor lighting

3.5 Communication Systems

.1 Install communications grounding system for bonding of all telephone, data, fire alarm, paging as follows:

.1 Provide minimum #6 AWG ground (or larger as indicated on drawings) from all voice/data, server, and IT communications rooms to main building ground.
.2 Provide grounding for utility telephone and data demarcation locations in accordance with utility requirements.
.3 Sound, fire alarm, and other communication systems as indicated.

3.6 Field Quality Control

.1 Perform ground continuity and resistance tests using fall-of-potential measurement system method per IEEE 81-2012 standards. A report shall be submitted to the Contract Administrator from the testing agency.

.2 Perform tests before energizing electrical system.

.3 Disconnect ground fault indicator, if provided, during tests.

.4 A ground electrode with an unsatisfactory resistance test result shall be altered as necessary until the required resistance reading is achieved.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Conduit and equipment supports.

.2 Anchors and fasteners.

1.2 References

.1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.

.2 CECA - Canadian Electrical Contractors Association.

.3 CSA (Canadian Standards Association).

.4 ULC (Underwriters' Laboratories of Canada).

1.3 Submittals For Review

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Product Data: Provide manufacturer's catalogue data for fastening systems.

1.4 REGULATORY REQUIREMENTS

.1 Provide products listed and classified by CSA and as suitable for purpose specified and shown.

Part 2 Products

2.1 Product Requirements

.1 Materials and Finishes: Provide adequate corrosion resistance.

.2 Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

.3 Anchors and Fasteners:

- .1 Concrete Structural Elements: Use expansion anchors.
- .2 Steel Structural Elements: Use beam clamps and spring steel clips.
- .3 Concrete Surfaces: Use expansion anchors.
- .4 Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
- .5 Solid Masonry Walls: Use expansion anchors.
- .6 Sheet Metal: Use sheet metal screws.
- .7 Wood Elements: Use wood screws.

2.2 Steel Channel

.1 U-shape, galvanized steel, size 1.6" x 1.6" (40 x 40 mm), 0.1" (2.5 mm) thick, surface-mounted, suspended or set in poured concrete walls and ceilings as required.

2.3 INSTALLATION

.1 Install products to manufacturer's written instructions.

.2 Provide anchors, fasteners, and supports to CSA-C22.1.

.3 Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

.4 Do not use powder-actuated anchors.

.5 Obtain permission from Contract Administrator before using powder-actuated anchors.

.6 Do not drill or cut structural members.

.7 Obtain permission from Contract Administrator before drilling or cutting structural members.

.8 Do not use plastic cable ties.

.9 Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

.10 Install surface-mounted cabinets and panelboards with minimum of four anchors.

.11 In wet and damp locations use steel channel supports to stand cabinets and panelboards 25 mm (1 inch) off wall.

.12 Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Electrical metallic tubing.

.2 Non-metallic conduit.

1.2 Related Sections

.1 Section 07 84 00 - Firestopping.

.2 Section 26 05 34 - Boxes.

.3 Section 26 05 26 - Grounding And Bonding.

.4 Section 26 05 29 - Electrical Supporting Devices.

.5 Section 26 05 53 - Electrical Identification.

1.3 References

.1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2 No. 18.1-13 (R2018) - Metallic Outlet Boxes.

.3 CSA-C22.2 No. 83.1-07 (R2017) - Electrical Metallic Tubing - Steel.

.4 CSA C22.2 No. 211.1-06 (R2016) - Rigid Types EB1 and DB2/ES2 PVC Conduit.

.5 CSA C22.2 No. 211.2-06 (R2016) - Rigid PVC (Unplasticized) Conduit.

.6 CSA (Canadian Standards Association).

.7 ULC (Underwriters' Laboratories of Canada).

1.4 Administrative Requirements

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

1.5 Closeout Submittals

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Record Documentation:

.1 Accurately record actual routing of conduits equal to or larger than 35mm (1-1/4").

.2 Accurately record actual routing of backbone conduit runs.

.3 Accurately record actual routing of all conduit in slab.

1.6 Regulatory Requirements

.1 Design conduit size to CSA-C22.1.

.2 Provide products listed and classified by CSA or ULC as suitable for purpose specified and shown.

1.7 Delivery, Storage, And Protection

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Accept conduit on site. Inspect for damage.

.3 Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

.4 Protect PVC conduit from sunlight.

Part 2 Products

2.1 Conduit Requirements

.1 Minimum Size: 21 mm (3/4 inch) unless otherwise specified.

.2 Underground Installations:

.1 More than 1525 mm (5 ft) from Foundation Wall: Use thick wall non-metallic conduit.

.2 Within 1525mm (5 ft) from Foundation Wall: Use rigid steel conduit.

.3 In or Under Slab on Grade: Use thick wall non-metallic conduit.

.4 Minimum Size: 27mm (1 inch).

.5 Provide a separate ground wire in all below-grade conduits.

.6 Provide an exterior trace wire for all conduits containing non-current carrying cabling.

.7 Use waterproof fittings.

.3 Outdoor Locations, Above Grade: Use rigid steel conduit.

.4 In Slab:

.1 Use electrical non-metallic tubing.

.5 Wet and Damp Locations: Use non-metallic conduit.

.6 Dry Locations:

.1 Concealed: Use electrical metallic tubing.

.2 Exposed: Use electrical metallic tubing.

.7 Hazardous Areas: Use rigid steel conduit or TECK cable complete with conduit seal fittings and compound.

2.2 Electrical Metallic Tubing (emt)

.1 Description: CSA C22.2 N0. 83.1; galvanized tubing.

.2 Fittings and Conduit Bodies: CSA C22.2 No. 83.1; steel, set screw type in dry locations, watertight connectors in sprinklered areas

.3 Refer to Section 26 05 53 for colour requirements.

2.3 Non-metallic Conduit

.1 Description: CSA C22.2 No. 211.2; PVC.

.2 Fittings and Conduit Bodies: CSA C22.2 No. 211.2.

.3 Provide a separate ground wire in all non-metallic conduit

2.4 Fittings

.1 Fittings shall be manufactured for use with conduit specified.

.2 Insulated throat liners on connectors.

.3 Steel raintight connector fittings complete with O-rings, for use on weatherproof or sprinklerproof enclosures. Steel raintight couplings shall be used for surface conduit installation exposed to moisture or sprinkler heads. Steel raintight connectors shall be used for all top entries to panels, contactors and motor control centres.

.4 Expansion fittings

.1 Outdoor locations - Weatherproof expansion fittings with internal bonding assembly, suitable for 100 mm (4") or 200 mm (8") linear expansion.

.2 Wet and Damp Locations - Watertight expansion fittings with integral bonding jumper suitable for linear expansion, and 21 mm (3/4") deflection in all directions, as required.

.3 Panel Entry - Weatherproof expansion fittings for linear expansion as required.

.4 PVC Conduit - O-ring type expansion fittings.

.5 Flexible watertight conduit between junction boxes with integral bonding jumper suitable for linear and lateral movement greater than 19 mm (3/4”).

Part 3 Execution

3.1 Examination

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Verify that field measurements are as shown on Drawings.

.3 Verify routing and termination locations of conduit prior to rough-in.

.4 Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

.5 Drawings do not contain all conduits. Provide all conduit as required for a complete system.

.6 All conduit sizes indicated on drawings are minimum sizes unless otherwise noted. Where larger conduit sizes are required to meet Canadian Electrical Code requirements, contractor shall provide larger size at no additional cost. Increase conduit size at no extra costs where required to accommodate length of run and voltage drop requirements in accordance with Canadian Electrical Code requirements.

3.2 Installation

.1 Install conduit to CSA C22.1.

.2 Install non-metallic conduit to manufacturer's written instructions.

.3 Arrange supports to prevent misalignment during wiring installation.

.4 Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

.5 Group related conduits; support using conduit rack.

.6 Construct rack using steel channel. Provide space on each for 25% additional conduits.

.7 Fasten conduit supports to building structure and surfaces to Section 26 05 29.

.8 Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

.9 Do not attach conduit to ceiling support wires.

.10 Arrange conduit to maintain headroom and present neat appearance.

.11 Provide flexible metal conduit for all connections to motors, recessed lighting, suspended lighting, transformers, and equipment subject to movement or vibration.

.12 Conduit Routing:

.1 All conduit shall be concealed except in mechanical and electrical rooms or as otherwise noted.

.2 Where surface conduit is installed:

.1 Locate more than 2000 mm (78 inches) from infrared or gas-fired heaters.

.2 Group conduits on suspended or surface rack support.

.3 Route conduit parallel and perpendicular to walls.

.4 Route conduit installed above accessible ceilings parallel and perpendicular to walls.

.5 Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.

.6 Route conduit in and under slab from point-to-point.

.7 Do not route conduits through structural members unless otherwise indicated.

.8 Do not route conduit through terrazzo or concrete toppings unless otherwise indicated.

.9 Do not route conduit horizontally in masonry walls unless otherwise indicated.

.10 Do not cross conduits in slab.

.13 Conduits in Poured Concrete:

.1 Submit marked up drawings of proposed conduit routing complete with conduit sizes to Structural and Electrical consultants for approval prior to installation.

.2 Coordinate installation of conduit to suit reinforcing steel.

.3 Locate in centre third of slab.

.4 Provide minimum separation of 150 mm (6”) between parallel conduit runs.

.5 Do not install conduit in drop panels, beams, or columns unless approved by the Structural Contract Administrator.

.6 Where conduits are grouped, or do not follow perpendicular to parallel to building lines, provide photos in electronic format (minimum resolution 1920x1080) of conduit installation prior to concrete pour.

.7 Record drawings shall indicate location of all conduit embedded in concrete, or run below slab complete with dimensions to building lines.

.8 For slab-on-grade, conduit larger than 27 mm (1”) shall be routed below slab and encased in minimum 75 mm (3”) of concrete.

.14 All conduit below grade shall be sloped to provide drainage away from the building.

.15 Maintain adequate clearance between conduit and piping.

.16 Maintain 300 mm (12 inch) clearance between conduit and surfaces with temperatures exceeding 40 degrees C (104 degrees F).

.17 Cut conduit square using saw or pipe cutter; de-burr cut ends.

.18 Bring conduit to shoulder of fittings; fasten securely.

.19 Where threaded connections are used, threads shall be of sufficient length to ensure a tight connection.

.20 Where conduit becomes blocked, remove and replaced blocked sections.

.21 Join non-metallic conduit using cement as recommended by manufacturer.

.1 Wipe non-metallic conduit dry and clean before joining.

.2 Apply full even coat of cement to entire area inserted in fitting.

.3 Allow joint to cure for 20 minutes, minimum.

.22 Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

.23 Install no more than equivalent of two 90-degree bends between boxes.

.1 Use conduit bodies to make sharp changes in direction, as around beams.

.2 Use hydraulic one-shot bender to fabricate and factory elbows for bends in metal conduit larger than 53 mm (2 inch) size.

.3 All metallic conduit shall be bent cold. Replace sections where conduit is kinked or flattened by more than 10% of its original diameter.

.24 Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

.25 Ensure conduit systems are dry prior to installation of wiring.

.26 Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic and control expansion joints, and where conduit transitions from below to above grade.

.27 Provide polypropylene pull string in each empty conduit except sleeves and nipples.

.28 Use suitable caps to protect installed conduit against entrance of dirt and moisture.

.29 Ground and bond conduit to Section 26 05 26.

.30 Identify conduit to Section 26 05 53.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Wall and ceiling outlet boxes.

.2 Pull and junction boxes.

1.2 Related Sections

.1 Section 07 84 00 - Firestopping.

.2 Section 26 27 26 - Wiring Devices.

.3 Section 26 27 16 - Cabinets And Enclosures.

1.3 References

.1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2 No. 18.1-13 (R2018) - Metallic Outlet Boxes.

.3 CSA C22.2 No. 40-17 - Junction and Pull Boxes.

.4 CSA C22.2 No. 85-14 - Rigid PVC Boxes and Fittings.

.5 CSA (Canadian Standards Association).

.6 ULC (Underwriters' Laboratories of Canada).

1.4 Administrative Requirements

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate installation of outlet box for equipment connected under Section 26 05 80.

1.5 Closeout Submittals

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Record Documentation: Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.6 Regulatory Requirements

.1 Products: Listed and classified by CSA or ULC, and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Outlet Boxes

.1 Sheet Metal Outlet Boxes: CSA-C22.2 No. 18, galvanized steel.

.1 Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 13 mm (1/2 inch) male fixture studs where required.

.2 Concrete Ceiling Boxes: Concrete type.

.2 Non-metallic Outlet Boxes: CSA-C22.2 No. 18.

.3 Cast Boxes: CSA-C22.2 No. 18, Type FS or FD as indicated or as required, cast ferric alloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.

.4 In-wall Boxes: 18 gauge white powder coated steel complete with trim ring, will accept standard single gang outlet boxes, wiring devices and cover plates, complete with screw-on steel cover with cable exit.

.5 Wall Plates for Finished Areas: As specified in Section 26 27 26.

2.2 Pull And Junction Boxes

.1 Sheet Metal Boxes: CSA-C22.2 No. 18, galvanized steel.

.2 Hinged Enclosures: As specified in Section 26 27 16.

.3 Surface Mounted Cast Metal Box: CSA-C22.2 No. 18, Type 4 or Type 6 as required or as indicated; flat-flanged, surface mounted junction box:

.1 Material: Galvanized cast iron.

.2 Cover: Provide with ground flange, neoprene gasket, and stainless steel cover screws.

.4 In-Ground Cast Metal Box: CSA-C22.2 No. 18, Type 6, flanged, recessed cover box for flush mounting:

.1 Material: Galvanized cast iron.

.2 Cover: Non-skid cover with neoprene gasket and stainless steel cover screws.

.3 Cover Legend: "ELECTRIC".

.5 Fibreglass Hand Holes: Die moulded glass fibre hand holes:

.1 Cable Entrance: Pre-cut 150 x 150 mm (6 x 6 inch) or as indicated, cable entrance at centre bottom of each side.

.2 Cover: Glass fibre weatherproof cover with non-skid finish.

Part 3 Execution

3.1 Examination

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Verify locations of floor boxes and outlets throughout prior to rough-in.

3.2 Installation

.1 Install boxes to CSA-C22.1.

.2 Install in locations as shown on drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

.3 Set wall mounted boxes at elevations to accommodate mounting heights specified in section for outlet device and as indicated. Coordinate locations with architectural drawings.

.4 Electrical boxes are shown on drawings in approximate locations unless dimensioned. Adjust box location up to 3 m (10 ft) if required to accommodate intended purpose.

.5 Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

.6 Maintain headroom and present neat mechanical appearance.

.7 Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

.8 Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 150 mm (6 inches) from ceiling access panel or from removable recessed luminaire.

.9 Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

.10 Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

.11 Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

.12 Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

.13 Use flush mounting outlet box in finished areas.

.14 Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

.15 Do not install flush mounting box back-to-back in walls; provide minimum 150 mm (6 inches) separation. Provide minimum 600 mm (24 inches) separation in acoustic rated walls.

.16 Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

.17 Use stamped steel bridges to fasten flush mounting outlet box between studs.

.18 Install flush mounting box without damaging wall insulation or reducing its effectiveness.

.19 Use in-wall boxes for wall mounted television and smart board power and communications applications.

.20 Do not install in-wall box back-to-back in walls; provide minimum 150 mm (6 inches) separation. Provide minimum 600 mm (24 inches) separation in acoustic rated walls.

.21 Secure in-wall box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

.22 Use stamped steel bridges to fasten in-wall outlet box between studs.

.23 Install in-wall mounting box without damaging wall insulation or reducing its effectiveness.

.24 Use adjustable steel channel fasteners for hung ceiling outlet box.

.25 Do not fasten boxes to ceiling support wires.

.26 Support boxes independently of conduit.

.27 Use gang box where more than one device is mounted together.

.28 Use gang box with plaster ring for single device outlets.

.29 Use cast outlet box in exterior locations where exposed to the weather and wet locations.

.30 Large Pull Boxes: Where pull boxes have a long dimension of 305 mm (12 inches) or more, use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.3 Adjusting

.1 Adjust floor box flush with finish flooring material.

.2 Adjust flush-mounting outlets to make front flush with finished wall material.

.3 Install knockout closures in unused box openings.

3.4 Cleaning

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Clean interior of boxes to remove dust, debris, and other material.

.3 Clean exposed surfaces and restore finish.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Nameplates and labels.

.2 Wire markers.

.3 Conduit markers.

1.2 Related Sections

.1 Section 09 90 00 - Painting.

1.3 References

.1 CSA (Canadian Standards Association).

.2 ULC (Underwriters' Laboratories of Canada).

1.4 Submittals For Review

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Product Data: Provide catalogue data for nameplates, labels, and markers.

.3 Installation Data: Provide list of all equipment requiring nameplates complete with associated nameplate configuration for review.

1.5 Regulatory Requirements

.1 Provide products listed and classified by CSA or ULC and as suitable for purpose specified and shown.

1.6 Language

.1 All identification shall be in English.

Part 2 Products

2.1 Nameplates And Labels

.1 Nameplates:

.1 Exterior –Stainless steel, etched and color filled with stamped product specific labelling.

.2 Interior - Engraved three-layer laminated plastic, white letters on blue background for normal power and systems, white letters on red background for life safety power and systems, and white letters on orange background for standby power and systems.

.3 Locations:

.1 Electrical distribution, motor control centres, disconnect switches, panelboards and control equipment enclosures.

.1 Nameplate shall include:

.1 Distribution Name

.2 Distribution Voltage, Phase, Wires, Amperage

.3 Room Location

.4 Fed From:

.1 Panel Name

.2 Supplying Breaker Size/Poles

.3 Room Location

.2 Electrical distribution and motor control centres.

.1 Nameplates at individual breakers shall include:

.1 Load Name

.2 Room Location of Load

.3 Breaker Size/Poles

.3 Electrical distribution and panelboards where breakers are applied in series ratings shall also include:

.1 "BREAKERS ARE INSTALLED IN A SERIES RATED COMBINATION AND SHALL ONLY BE REPLACED WITH COMPONENTS OF THE SAME TYPE AND RATING."

.4 Circuit breakers and fused switches which directly feed a single conductor cable shall include the maximum continuous load allowed:

.1 "MAXIMUM CONTINUOUS LOAD: X AMPS"

.5 Adjustable circuit breakers shall include the maximum continuous load allowed:

.1 "MAXIMUM CONTINUOUS LOAD: X AMPS"

.6 Mechanical equipment disconnect switches:

.1 Nameplate shall include:

.1 Mechanical Equipment Mark

.2 Panel Name & Circuit number

.7 Fire Alarm System Equipment

.1 Nameplate shall include:

.1 Room Number

.2 Equipment Name

.3 Fed From:

.1 Room Number.

.2 Panel Name and Circuit Number

.8 Fire Alarm Equipment Branch Circuit Breakers

.1 Nameplate shall be red and meet AHJ requirements. Nameplate shall indicate "FIRE ALARM PANEL", "NACPS" etc. or approved wording.

.4 Letter Size:

.1 Use 6mm (1/4 inch) letters for identifying equipment mark designations and system types.

.2 Use 3mm (1/8 inch) letters for identifying supporting information.

.3 Use 6mm (1/4 inch) letters for identifying grouped equipment and loads.

.5 Nameplates on exterior equipment shall be UV & weather resistant.

.6 Wording on nameplates shall be approved prior to manufacture. Submit schedule of nameplates and wording.

.2 Labels: Plastic self-adhesive non-smear labels with 5mm (3/16 inch) black letters on white background.

.1 Locations:

.1 Wiring devices, including lighting control devices and receptacles.

.1 Label shall include:

.1 Indicate associated panel and circuit number.

.2 E.g. “A-32” (A is for Panel-A, and 32 is the circuit number)

.3 Lighting controls to include brief description of lighting being controlled.

.4 E.g. “Pendants”

2.2 Wire Markers

.1 Wire Markers: Permanent tape type wire markers not susceptible to thermal or mechanical influence.

.2 Locations:

.1 Each conductor at panelboard gutters, pull boxes, outlet and junction boxes and each load connection.

.1 Legend:

.1 Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

.2 Control Circuits: Control wire number indicated on Shop Drawings.

2.3 Conduit Markers

.1 Manufacturers:

.1 Brady; Product: BMP71 Indoor/Outdoor Vinyl Labels.

.2 Substitutions: Refer to Section 26 05 00.

.2 Description: Vinyl label.

.3 Location: Provide markers for each conduit longer than 4.7 m(10 ft).

.4 Spacing: 6m (20 ft) on centre.

.5 Colour:

.1 Normal Power System: Blue

.2 Life-Safety Power System: Red

.3 Standby Power System: Orange

.4 Fire Alarm System: Red.

.5 Communication System: Yellow

.6 Legend:

.1 600 Volt System: 600V.

.2 120/208 Volt System: 120/208V.

.3 Fire Alarm System: FIRE ALARM.

.4 Communication System:

.1 VOICE

.2 DATA

.3 VOICE/DATA

.5 Public Address System: PA

.6 CCTV System: CCTV

.7 Access Control System: ACCESS CONTROL

Part 3 Execution

3.1 Preparation

.1 Degrease and clean surfaces to receive nameplates and labels.

3.2 Application

.1 Install nameplate and label parallel to equipment lines.

.2 Secure nameplate to equipment front using rivets or screws.

.3 Conduit shall be integrally colour coded through a colouring process applied by the conduit manufacturer.

.4 Colour:

.1 600 Volt System: Orange

.2 208 Volt System: Blue

.3 Fire Alarm System: Red.

.4 Communication System: Yellow

.5 Identify underground conduits using underground warning tape. Install one tape per trench at 75mm (3 inches) below finished grade.

.6 Provide identification on all junction box covers indicating associated system, panel and circuit numbering using permanent marker.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Hinged cover enclosures.

.2 Cabinets.

.3 Terminal blocks.

.4 Accessories.

1.2 Related Sections

.1 Section 26 05 29 - Electrical Supporting Devices.

1.3 References

.1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.

.2 CAN/CSA-C22.2 No. 94-M91 (R2006) - Special Purpose Enclosures.

.3 CSA-C22.2 No. 158-10 - Terminal Blocks.

.4 CSA (Canadian Standards Association).

.5 ULC (Underwriters' Laboratories of Canada).

1.4 Submittals For Review

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Product Data: Provide manufacturer's standard data for enclosures and cabinets.

1.5 Submittals For Information

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Installation Data: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 Maintenance Material Submittals

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Extra Stock Materials: Provide two (2) of each key.

1.7 Regulatory Requirements

.1 Conform to requirements of CSA-C22.1.

.2 Products: Listed and classified by CSA and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Hinged Cover Enclosures

.1 Construction: CAN/CSA-C22.2 No. 94.

.1 Surface Mounted Indoor: Type 1 16 gauge steel enclosure complete with sprinkler drip hood.

.2 Recessed Mounted Indoor: Type 2 16 gauge steel enclosure.

.3 Exterior Use: Type 4 14 gauge steel enclosure or as indicated.

.2 Covers: Surface or Flush cabinet front with continuous hinge,

.1 Indoor: Held closed by flush latch operable by key.

.2 Outdoor: Held closed by hasp and staple for padlock.

.3 Provide interior metal panel for mounting terminal blocks and electrical components; finish with white enamel.

.4 Enclosure Finish: Manufacturer's standard grey enamel.

2.2 Cabinets

.1 Boxes: Galvanized steel with removable end walls.

.2 Box Size: 600mm (24 inches) wide x 150mm (6 inches) deep.

.3 Backboard: Provide 19mm (3/4 inch) thick plywood backboard for mounting terminal blocks. Paint matte white.

.4 Fronts: Steel, surface type with screw cover front and door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.

.5 Provide metal barriers to form separate compartments wiring of different systems and voltages.

.6 Provide accessory feet for free-standing equipment.

2.3 Terminal Blocks

.1 Substitutions: Refer to Section 26 05 00.

.2 Terminal Blocks: CSA-C22.2 No. 158.

.3 Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.

.4 Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.

.5 Provide ground bus terminal block, with each connector bonded to enclosure.

2.4 Accessories

.1 Description: Plastic channel with hinged or snap-on cover.

Part 3 Execution

3.1 Installation

.1 Install components to CSA-C22.1 and to manufacturer's written instructions.

.2 Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner to Section 26 05 29.

.3 Install cabinet fronts plumb.

3.2 Cleaning

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Clean electrical parts to remove conductive and harmful materials.

.3 Remove dirt and debris from enclosure.

.4 Clean finishes and touch up damage.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Wall switches.

.2 Device plates and decorative box covers.

1.2 Related Sections

.1 Section 26 05 34 - Boxes.

1.3 References

.1 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.

.2 CSA C22.2 No. 42-10 (R2015) - General Use Receptacles, Attachment Plugs, and Similar Wiring Devices

.3 CSA C22.2 No. 42.1-13 (R2017) - Cover Plates for Flush-Mounted Wiring Devices.

.4 CSA C22.2 No. 55-15 - Special use switches.

.5 CAN/CSA C22.2 No. 111-18 - General-Use Snap Switches.

.6 CSA C22.2 No. 184-15 - Solid-State Lighting Controls.

.7 CSA (Canadian Standards Association).

.8 ULC (Underwriters' Laboratories of Canada).

1.4 Submittals For Review

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Product Data: Provide manufacturer's catalogue information showing dimensions, colours, and configurations.

1.5 Submittals For Information

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Installation Data: Submit manufacturer's installation instructions.

1.6 Maintenance Material Submittals

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Extra Stock Materials:

.1 Provide two (2) of each style, size, and finish wall plate.

1.7 Quality Assurance

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

1.8 Regulatory Requirements

.1 Provide products listed and classified by CSA and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Wall Switches

.1 Manufacturers:

.1 Leviton
.2 Hubbell
.3 Cooper
.4 Legrand
.5 Substitutions: Refer to Section 26 05 00.

.2 General-use snap switch:

.1 Grade: Commercial Specification Grade CSA-C22.2 No. 111
.2 Style: Standard toggle
.3 Device Body: White nylon toggle.
.4 Ratings: Match branch circuit and load characteristics. Amperage rating shall be marked on body of switch.

.3 Body and Handle: White with nylon toggle.

.4 Indicator Light: Separate pilot strap red colour with load on.

.5 Locator Pilot Light: Separate pilot strap red colour.

2.2 Receptacles

.1 Manufacturers:

.1 Leviton
.2 Hubbell
.3 Cooper
.4 Legrand
.5 Substitutions: Refer to Section 01 62 00.

.2 General-duty duplex convenience receptacle:

.1 Grade: Commercial Specification Grade Nema WD-6 Compliant, CSA-C22.2 No.42.
.2 Style: Standard.
.3 Device Body: Smooth white nylon face and base.
.4 CSA Configuration: Type as specified and indicated.
.5 Tamper resistant as indicated or as per Electrical Code.

.3 Isolated Ground Receptacle: General-duty duplex receptacle with insulation barrier between green grounding screw and metal box mounting strap. Device body shall be smooth orange nylon face with “IG triangle”.

.4 Suitable for No. 10 AWG for back and side wiring.

.5 Break-off links for use as split receptacles.

.6 Double wipe contacts and riveted grounding contacts.

.7 Receptacles shall be of one manufacturer throughout the project.

2.3 Wall Plates

.1 Standard Stainless Steel Cover Plate: 430 type stainless steel cover plate complete with protective plastic film. Combination or multi-gang covers as required or indicated. Jumbo or standard size as indicated or specified.

.2 Metallic While-in-Use covers: Nema 3R rated, die-cast aluminum construction with powder coated “chip resistant” paint corrosion protection and plug/cord management, suitable for horizontal mounting on device box only, and padlock provision.

.3 Thermoplastic While-in-Use covers: Nema 3R rated, thermoplastic construction, suitable for horizontal mounting on device box only, and padlock provision.

.4 Weatherproof Cover Plate: Gasketed cast metal with gasketed double hinged device covers suitable for horizontal mounting on device box only. Provide single hinged device cover for GFI type receptacle only.

2.4 Accessories:

.1 Audible Device Vandal Guard: Clear vandal resistant, UV Stabilized polycarbonate shield and frame complete with integral 95db piezo horn and battery. Flush mounted or surface as indicated. Outdoor rated as required. Vandal guard shall be equal to STI Stopper II series.

.2 Device Vandal Guard: Clear vandal resistant, UV Stabilized polycarbonate shield and frame. Flush mounted or surface as indicated. Outdoor rated as required. Vandal guard shall be equal to STI Stopper II series.

Part 3 Execution

3.1 Examination

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Verify that outlet boxes are installed at proper height.

.3 Verify that wall openings are neatly cut and will be completely covered by wall plates.

.4 Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

.5 Verify that openings in access floor are in proper locations.

3.2 Preparation

.1 Provide extension rings to bring outlet boxes flush with finished surface.

.2 Clean debris from outlet boxes.

3.3 Installation

.1 Install to CSA-C22.1 and to manufacturer's written instructions.

.2 Install devices plumb and level.

.3 Install switches with OFF position down.

.4 Provide neutral conductor in box for all line voltage lighting control devices.

.5 Install wall dimmers to achieve full rating specified and indicated after de-rating for ganging as instructed by manufacturer.

.6 Do not share neutral conductor on load side of dimmers.

.7 Install receptacles with grounding pole on bottom.

.8 Connect wiring device grounding terminal to branch circuit equipment grounding conductor and outlet box.

.9 Install locator pilot light for lighting controls located in crawlspace.

.10 Install decorative plates on switch, receptacle, and blank outlets in finished areas.

.11 Connect wiring devices by wrapping conductor around screw terminal.

.12 Use jumbo size plates for outlets installed in masonry walls.

.13 Stainless steel protective coverings shall be maintained until project completion and turn-over to owner.

.14 Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

.15 Use weatherproof covers for parking receptacles, and dust-tight applications only, or as indicated.

.16 Install protective rings on active flush cover service fittings.

3.4 Interface With Other Products

.1 Coordinate locations of outlet boxes provided under Section 26 05 34 to obtain mounting heights specified and as indicated on drawings.

.2 Coordinate installation of access floor boxes with access floor system.

.3 Coordinate the installation of wiring devices with underfloor duct service fittings provided under Section 26 05 39.

3.5 Field Quality Control

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Inspect each wiring device for defects.

.3 Operate each wall switch with circuit energized and verify proper operation.

.4 Verify that each receptacle device is energized.

.5 Test each receptacle device for proper polarity.

.6 Test each GFCI receptacle device for proper operation.

3.6 Adjusting

.1 Adjust devices and wall plates to be flush and level.

3.7 Cleaning

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Luminaires.

.2 LED luminaires and drivers.

.3 Luminaire accessories.

1.2 Related Sections

.1 Section 23 82 00 - Terminal Heat Transfer Units: Air distribution accessories for air handling luminaires.

1.3 References

.1 ANSI/NEMA C78.379-2006 - American National Standard for Electric Lamps - Classification of the Beam Patterns of Reflector Lamps.

.2 CSA-C22.1-18 - Canadian Electrical Code, Part I (24th Edition), Safety Standard for Electrical Installations.

.3 CSA-C22.2 No. 9.0-96 (R2006) - General Requirements for Luminaires.

.4 CSA-C22.2 No. 250.0-08 - Luminaires.

.5 NEMA WD 6-2002 (R2008) - Wiring Devices - Dimensional Requirements.

.6 CSA (Canadian Standards Association).

.7 ULC (Underwriters' Laboratories of Canada).

1.4 Submittals For Review

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

.3 Product Data: Provide dimensions, ratings, and performance data.

1.5 Submittals For Information

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Installation Data: Submit data indicating application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 Closeout Submittals

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Operation and Maintenance Data: Submit manufacturer's operation and maintenance instructions for each product.

1.7 Maintenance Material Submittals

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Extra Stock Materials:

.1 Provide two (2) of each plastic lens type.

.2 Provide ten (10) replacement lamps for each lamp type.

.3 Provide two (2) of each ballast type.

1.8 Quality Assurance

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.

.2 Conform to requirements of CSA C22.1, and to the Manitoba Hydro Power Smart Commercial Lighting Program.

.3 Products: Listed and classified by CSA, and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Luminaires

.1 Manufacturers:

.1 Refer to Luminaire Schedule on drawings.

.2 Substitutions: Refer to Section 26 05 00 Common Work Results for Electrical.

.1 All requests for substitutions shall be complete with photometric layouts indicating proposed luminaire performance in a 1' by 1' grid.

2.2 Led Luminaires And Drivers

.1 All Luminaires

.1 Comply with IES LM-79-08 Approved Method for measuring lumen maintenance of LED light sources.

.2 Comply with IES LM-80-08 Approved Method for electrical and photometric measurement of SSL product.

.3 LED's shall be Restriction of Hazardous Substances Directive (RoHS) compliant.

.4 LED arrays shall be sealed, high performance, long life type; minimum 70% rated output at 50,000 hours.

.5 LED luminaires shall deliver a minimum of 60 lumens per watt.

.1 LED's shall be "Bin No. 1" quality.

.6 Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.

.7 The LED light source shall be fully dimmable with use of compatible dimmers switch designated for low voltage loads.

.8 LED color temperatures: CRI 85, 2700K as noted +/- 145K.

.9 LED color temperatures: CRI 85, 4000K as noted +/- 275K.

.10 LED color temperatures: CRI 85, 5000K as noted +/-283K.

.11 Luminaires shall have internal thermal protection.

.12 Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.

.13 Color spatial uniformity shall be within .004 of CIE 1976 diagram.

.14 Color maintenance over rated life shall be within .007 of CIE 1976.

.15 Indoor luminaires shall have a minimum CRI of 85.

.16 Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management

.17 LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver a minimum 70% of initial lumens, when installed in-situ, for a minimum of 50,000 hours.

.18 Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.

.2 Power Supplies and Drivers

.1 MB Hydro Powersmart approved.

.2 Power Factor: 0.90 or higher

.3 Maximum driver case temperature not to exceed driver manufacturer recommended in-situ operation.

.4 Output operating frequency: 60Hz.

.5 Interference: EMI and RFI compliant with FCC 47 CFR Part 15.

.6 Total Harmonic Distortion Rating: 20% Maximum.

.7 Meet electrical and thermal conditions as described in LM-80 Section 5.0.

.8 Primary Current: Confirm primary current with Drawings.

.9 Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.

.10 Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified control components.

.11 Solid-state control components to be integral or external per each specified luminaire. Remote control gear to be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.

.3 Controller and Control System

.1 System electronics driver / controller to use coordinated communication protocols: DMX512, 0-10V, DALI, or proprietary as required.

.2 The Contractor shall ensure that external control equipment is compatible with LED control requirements

.3 Provide connector types and wiring as appropriate for un-interrupted communication between devices, considering distance maximums, field obstructions, and accessibility. Ensure that connection points are optically isolated for system noise reduction.

.4 Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified power supplies and/or drivers

2.3 Accessories

.1 Description: Standard down light reflector shall be semi-specular unless noted otherwise.

.2 Joiner Fittings: As specified for linear lighting systems, or as required for end to end continuous row mounting as indicated on drawings. Fittings to match style and finish of luminaire specified.

.3 End Caps: As specified for linear lighting systems, or as required for end of row or stand-alone luminaire installations as indicated on drawings. End caps to match style and finish of luminaire specified.

.4 Power Cord: As required for suspended lighting systems where wiring is exposed between fixture canopy and fixture lamp assembly. Power cord shall match finish of lighting fixture. Provide 0-10V combination cable as required for dimming purposes.

Length of cable shall be suitable for minimum suspension length of 4'-0" from ceiling finish. Confirm final lengths with installation requirements.

.5 Wireguard: As specified for luminaire, or as indicated on the drawings.

.1 Gauge: Minimum 8 gauge unless noted otherwise.

.2 Color: Custom color to be confirmed by architect at time of shop drawing review.

2.4 Source Quality Control

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Certify fluorescent ballast design and construction by Certified Ballast Manufacturers, Inc.

Part 3 Execution

3.1 Installation

.1 Support luminaires larger than 600 x 1200mm (24 x 48 inch) size independent of ceiling framing.

.2 Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

.3 Install surface mounted luminaires, emergency lighting, and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

.4 Exposed Grid Ceilings: Fasten surface mounted luminaires to ceiling grid members using bolts, screws, or suitable clips.

.5 Install recessed luminaires to permit removal from below.

.6 Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

.7 Install clips to secure recessed grid-supported luminaires in place.

.8 Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated.

.9 Install end to end, or continuous rows of luminaires with appropriate joiner fittings to match the luminaire manufacturer and finish.

.10 Install linear lighting with appropriate end caps where practicable.

.11 Lighting installed in corridors shall be oriented to maximize light distribution along the corridor rather than across it.

.12 Install accessories provided with each luminaire.

.13 Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

.14 Bond products and metal accessories to branch circuit equipment grounding conductor.

.15 Install specified lamps in each luminaire, emergency lighting unit and exit sign.

3.2 Interface With Other Products

.1 Interface with air handling accessories provided and installed under Section 23 37 00.

3.3 Field Quality Control

.1 Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 Adjusting

.1 Aim and adjust luminaires as directed.

.2 Position exit sign directional arrows as indicated.

3.5 Cleaning

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Clean electrical parts to remove conductive and deleterious materials.

.3 Remove dirt and debris from enclosures.

.4 Clean photometric control surfaces as recommended by manufacturer.

.5 Clean finishes and touch up damage.

3.6 Closeout Activities

.1 Demonstration: Demonstrate luminaire operation for minimum of one (1) hours.

3.7 Protection Of Finished Work

.1 Refer to 26 05 00 Common Work Results for Electrical.

.2 Re-lamp luminaires that have failed LED boards.

3.8 Schedules

.1 As indicated on drawings.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 Fire alarm control panels.

.2 Fire alarm initiating and signaling devices.

.3 Auxiliary fire alarm equipment and wiring.

1.2 Related Sections

.1 Section 08 71 00 - Door Hardware - General: Door closers, electric locks, electric releases.

.2 Section 21 13 00 - Sprinklers.

.3 Section 26 05 00 - Common Work Results for Electrical

.4 Section 26 05 19 - Building Wire and Cable.

1.3 References

.1 The latest version of the following including all amendments:

.1 CAN/ULC S524 - Standard for the Installation of Fire Alarm Systems.

.2 CAN/ULC S525 - Audible Signal Devices for Fire Alarm Systems, Including Accessories.

.3 CAN/ULC S526 - Visible Signal Devices for Fire Alarm Systems.

.4 CAN/ULC S527 - Control Units for Fire Alarm Systems

.5 CAN/ULC S528 - Manual Pull Stations for Fire Alarm Systems.

.6 CAN/ULC S529 - Smoke Detectors for Fire Alarm Systems.

.7 CAN/ULC S530 - Heat Actuated Fire Detectors for Fire Alarm Systems.

.8 CAN/ULC S536 - Inspection and Testing of Fire Alarm Systems.

.9 CAN/ULC-S537 - Standard for Verification of Fire Alarm Systems.

.10 CAN/ULC S541 - Speakers for Fire Alarm Systems, Including Accessories.

.11 ULC ORD-C386-1990 - Flame Detectors.

1.4 System Description

.1 Existing fire alarm system is based on is a fully supervised, manual and automatic, single stage addressable fire alarm control panel (FACP) Simplex 4100.

.2 All existing conventional initiating devices located in the crawlspace shall be demolished throughout and replaced with new addressable initiating devices, compatible with the existing FACP.

.3 The existing heat detection cable located in the crawlspace shall be retained.

.4 The fire alarm system shall include, but not be limited to the following:

.1 Control panel

.2 Trouble signal devices

.3 Power supplies and booster facilities

.4 Manual alarm stations

.5 Automatic alarm initiating devices

.6 Audible and visual signal devices
.7 End-of-line devices
.8 Annunciators
.9 Ancillary devices
.10 Input and output modules
.11 Isolator modules

1.5 Submittals For Review

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide electrical characteristics and connection requirements.

.3 Shop Drawings:

.1 Provide control panel and annunciator layout

.2 Provide system wiring diagram showing each device and wiring connection required.

.1 Wiring diagram shall be specific to the project and shall meet manufacturers recommendations and required building codes and standards.

1.6 Submittals For Information

.1 Section 01 33 00: Submission procedures.

.2 Test Reports: Indicate satisfactory completion of required tests and inspections.

.3 Installation Data: Manufacturer's special installation requirements.

.1 Indicate application conditions and limitations of use stipulated by Product testing agency.

.2 Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.

1.7 Closeout Submittals

.1 Section 01 78 10: Submission procedures.

.2 Maintenance Contracts: Provide service and maintenance of fire alarm system for one (1) year from Date of Substantial Completion.

.3 Operation Data: Operating instructions.

.4 Maintenance Data: Maintenance and repair procedures.

.5 Record Documentation: Record actual locations of initiating devices, signaling appliances, and end-of-line devices. Include zone number and device number for each device installed. Include circuit number for signalling appliances.

.6 Test reports from CAN/ULC S536 and CAN/ULC-S537 verification testing.

1.8 Maintenance Material Submittals

.1 Section 01 78 40: Maintenance and extra material requirements.

.2 Extra Stock Materials:

.1 Provide six (6) keys of each type.

.2 Provide three (3) of the following devices:

.1 Addressable manual station

.2 Addressable heat detector

.3 Ceiling mounted smoke detector

.4 Ceiling mounted combination smoke detector and fixed temperature heat detector

.5 Wall mounted combination horn/strobe, standard cd rating

.3 Provide two (2) addressable multi-criteria fire/CO detector

1.9 Quality Assurance

.1 Design and install fire alarm system to CAN/ULC S524.

.2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum fifteen (15) years documented experience and with service facilities within 160 km (100 miles) of Project.

1.10 Regulatory Requirements

.1 Products Requiring Electrical Connection: Listed and classified by ULC and as suitable for the purpose specified and indicated.

Part 2 Products

2.1 Manufacturers

.1 The fire alarm devices as described here-in are based on the Simplex 4100 fire alarm system performance only.

.2 Substitutions: Refer to Section 01 62 00.

2.2 Automatic Initiating Devices

.1 Heat Detector: Combination rate-of-rise and fixed temperature, rated 57 degrees C (135 degrees F) and temperature rate of rise of 8.3 degrees C (15 degrees F).

.1 Addressable heat detector shall be complete with inter-changeable plug-in base and loop polling LED (Green), and shall be equal to Notifier FST-851A.

.2 Non-Addressable moisture-proof heat detector shall be equal to Mircom CR-135-MP. Non-Addressable, moisture-proof heat detectors shall be used in crawlspaces only, or as indicated. Connect to addressable zone module as indicated.

.2 Ceiling Mounted Smoke Detector: Addressable photoelectric type with adjustable sensitivity with inter-changeable plug-in base and loop polling LED (Green). LED shall provide (Red) visual indication of detector actuation. Provide auxiliary relay contact as indicated. Provide sounder bases as indicated. Smoke detector shall be equal to Notifier FSP-851A.

.3 Ceiling Mounted Combination Smoke Detector and Fixed Temperature Heat Detector: Addressable photoelectric type smoke detector with adjustable sensitivity with inter-changeable plug-in base and loop polling LED (Green). LED shall provide (Red) visual indication of detector actuation. Fixed temperature shall be rated 57 degrees C (135 degrees F). Provide auxiliary relay contact as indicated. Provide sounder bases as indicated. Smoke detector shall be equal to Notifier FSP-851TA.

.4 Multi-Criteria Fire/CO Detector: Addressable combination detector combines smoke, CO, light/flame, and heat sensing technology in one device with adjustable sensitivity settings, and loop polling LED (Green). LED shall provide (Red) visual indication of detector actuation. Unit shall be complete with separate CO detection signal, and built-in CO cell

end-of-life warning and fault. Provide sounder base for local CO alarm only. Multi-Criteria Fire/CO Detector shall be equal to Notifier FCO-851(A).

2.3 MONITOR MODULES

.1 Fully addressable modules to facilitate the monitoring of the following:

.1 Sprinkler flow and tamper inputs

.2 Motorized damper open or closed status

.3 Generator common trouble input

.4 Fire pump running, loss of phase, phase reversal and controller connected to alternate source and common trouble.

.5 Dry contact input devices

2.4 Signal Line Isolator Modules

.1 Fully addressable isolator modules on a Class A initiating or notification device loop to suit CAN/ULC S524 and CAN/ULC S537.

2.5 End-of-line Devices

.1 End-of-line devices shall control supervisory current where required, and sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, initiating an alarm or trouble condition.

2.6 Fire Alarm Wire And Cable

.1 Fire Alarm Power Branch Circuits: Building wire as specified in Section 26 05 19.

.2 Initiating Device and Indicating Appliance Circuits:

.1 Description: Type FAS solid conductor, complete with red tinted interlocking armour as required

.2 Conductor: Copper unless otherwise noted.

.3 Insulation Voltage Rating: 300 volts.

.4 Insulation: Coded PVC insulation and with overall red PVC jacket in accordance with the Canadian Electrical Code, rated 105 degrees C. Use shielded cable as per manufacturer’s recommendations only.

.3 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.

.4 To audible signal circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

.5 To visual signal circuits: 12 AWG minimum, and in accordance with manufacturer's requirements.

.6 Wiring shall be as per manufacturer’s recommendations. All wiring shall be in red coloured conduit unless noted otherwise.

Part 3 Execution

3.1 Installation

.1 Install products to manufacturer's written instructions and CAN/ULC S524, local and national codes, as indicated, and as recommended by the manufacturer.

.2 All initiating and signalling devices, control panels and remote annunciators shall be flush mounted unless indicated otherwise.

.3 Install devices at heights indicated in Section 26 05 00.

.4 Locate detectors minimum 0.45m (18") from air discharge or return grille as measured from the edge of the detector, and not closer than 300 mm (12") to lighting fixtures.

.5 Locate ceiling mounted detectors minimum 100mm (4") from edge of ceiling where it meets the wall as measured from the edge of the detector.

.6 Detectors shall be located such that a clear space of 450mm is maintained between the detector and any obstructions except where ceiling mounted obstructions protrude less than 100 mm (4") from the ceiling.

.7 In areas without finished ceilings, mount detectors at underside of deck above unless otherwise indicated.

.8 Mount end-of-line devices in separate box adjacent to last device in circuit.

.9 Mount outlet box for electric door holder to withstand 36 kg (80 lbs) pulling force.

.10 Make conduit and wiring connections to duct smoke detectors, sprinkler valve tamper and flow switches, fire suppression system control panels, door release devices, smoke control fans and equipment.

.11 Circuiting for fire alarm devices shall be as follows:

.1 Provide Class "A" addressable initiating/alarm circuits throughout unless indicated otherwise.

.2 Provide Class "B" audible/visual signal circuits for signal circuits throughout unless indicated otherwise.

.3 Provide Class "A" audible/visual signal circuits for residential dwelling unit signal circuits only.

.4 Circuits shall have a minimum 15% spare capacity for future system expansion.

.5 All SLC, signal and power riser wiring shall be supervised, including internal wiring between modules.

.12 Where wiring is required to be surface mounted within finished areas, wiring shall be installed in a single piece metal raceway unless noted otherwise. Color of raceway shall be white unless noted otherwise.

.13 Where devices are surface mounted in finished areas, provide a surface mounted metal raceway device box. Color of box shall match the device.

.14 Where initiating devices are located within an attic space, and crawlspace, non-addressable type devices shall be used, connected to an addressable zone module located outside the attic space and/or crawlspace in an accessible location. Associated EOL's and Modules shall be clearly labelled.

.15 Where attic spaces and crawlspaces are compartmentalized, each compartment shall be wired in such a manner that each compartment is on a separate fire alarm zone. Provide additional zone modules as required.

3.2 Wiring Methods

.1 Concealed Dry Interior Locations: Use FAS wire in raceway for all main runs. Armoured Securex for individual device drops only.

.2 Exposed Dry Interior Locations: Use only FAS wire in raceway.

.3 Above Accessible Ceilings: Use FAS wire in raceway for all main runs. Armoured Securex for individual device drops only.

.4 Wet or Damp Interior Locations: Use only FAS wire in raceway.

.5 Underground Installations: Use only FAS wire in raceway.

3.3 Interconnections

.1 Interconnect with all systems and devices as identified on the drawings.

.2 Interconnect with all electromagnetic locks to release on fire alarm signal. Provide a manual release/reset keyswitch adjacent the fire alarm panel.

3.4 Field Quality Control

.1 Section 01 45 00: Field inspection and testing.

.2 Test to CAN/ULC S536 and CAN/ULC-S537 and local inspection authority requirements.

.3 Include services to re-test system one (1) month prior to completion of warranty.

3.5 Manufacturer's Field Services

.1 Section 01 78 10: Prepare and start components.

.2 Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.6 Closeout Activities

.1 Demonstration: Demonstrate normal and abnormal modes of operation, and required responses to each.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Grading of soil and cover in Crawlspace for drainage as shown on Drawings.

1.2 RELATED SECTIONS

.1 Section 31 23 00 – Excavation and Fill.

Part 2 Products

2.1 MATERIALS

.1 Fill material: In accordance with of Section 31 23 00 – Excavation and Fill.

.2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by the Contract Administrator.

Part 3 Execution

3.1 PREPARATION OF EXISTING GRADE

.1 Excavate existing grades to meet design grades in accordance with Section 31 23 00 – Excavation and Fill.

.2 Remove obstructions and debris/garbage from surfaces to being graded.

.3 Verify that grades are correct.

.1 If discrepancies occur, notify the Contract Administrator and do not commence work until instructed by Contract Administrator.

.4 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

.5 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.

.1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.

.2 Remove debris which protrudes more than 75 mm above surface.

.3 Dispose of removed material off site.

3.2 PLACING AND SPREADING OF FILL

.1 Place fill after Contract Administrator has accepted subgrade.

.2 Prior to placing fill, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.3 Compact filled and disturbed areas in accordance with Section 31 23 00 – Excavation and Fill.

3.3 GRADING

.1 Grade to eliminate rough spots and low areas and ensure positive drainage as shown on Drawings.

.1 Prepare loose friable bed by means of cultivation and subsequent raking.

3.4 SURPLUS MATERIAL

.1 Remove surplus material and material unsuitable for fill, grading or landscaping off site.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Excavation of existing soil and fill within Crawlspace in preparation of grading for crawlspace drainage as shown on Drawings.

.2 Compacted granular base for cast-in-place concrete slabs.

1.2 RELATED SECTIONS

.1 Section 02 41 19 - Selective Demolition

.2 Section 31 22 13 – Rough Grading.

1.3 MEASUREMENT PROCEDURES

.1 No measurement will be made under this section.

.2 Include costs for excavation and fill as a lump sum cost in the tender.

1.4 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D4491 / D4491M – 20, Standard Test Methods for Water Permeability of Geotextiles by Permittivity

.2 ASTM D4632 / D4632M - 15a, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

.3 ASTM D4751 - 20a, Standard Test Methods for Determining Apparent Opening Size of a Geotextile.

.4 ASTM D4759 - 11(2018), Standard Practice for Determining the Specification Conformance of Geosynthetics.

.2 City of Winnipeg Construction Specifications

.1 CW 3110 – Sub-Grade, Sub-Base and Base Course Construction.

1.5 QUALITY ASSURANCE

.1 Do not use soil material until written report of soil test results are reviewed by the Contract Administrator.

.2 Pre-installation meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling.

.2 Divert excess aggregate materials from landfill to local recycling facility.

1.7 EXISTING CONDITIONS

.1 Buried services:

.1 Before commencing work establish location of buried services.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work:

.1 Include costs of relocating services in the lump sum tender.

.3 Remove obsolete buried services.

.4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.5 Prior to beginning excavation Work, notify the Contract Administrator to establish location and state of use of buried utilities and structures.

.6 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.

.7 Where utility lines or structures exist in area of excavation, obtain direction of the Contract Administrator before removing and re-routing.

.8 Record location of maintained, re-routed and abandoned underground lines.

.9 Confirm locations of recent excavations adjacent to area of excavation.

.2 Existing buildings and surface features:

.1 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair to match existing.

Part 2 Products

2.1 MATERIALS

.1 Backfill: Material to be added to existing grade for drainage slopes as shown on Drawings and consist of:

.1 Excavated material removed from areas of the crawlspace scheduled for excavation to produce slopes as shown on Drawings.

.1 Free from organic or soft material that would disintegrate through decay or weathering.

.2 Well graded pit run material with the following grading:

Sieve Designation	% Passing
75 000	90-100
28 000	80-100
5 000	40 – 80
315	10 – 35
80	5 - 30

The material passing the 315 micrometre sieve shall have a liquid limit not greater than twenty-five (25) and a plasticity index not greater than six (6).

.2 Granular Fill: Sound hard 100% clear, washed, rounded gravel free from organic or soft material that would disintegrate through decay or weathering, well graded throughout and graded as follows:

Sieve Designation	% Passing
20 000	100
5 000	40 - 70
2 500	25 – 60
315	8 – 25
80	6 - 17

The material passing the 315 micrometre sieve shall have a liquid limit not greater than twenty-five (25) and a plasticity index not greater than six (6).

.3 Clean Stone: Pea Gravel directly adjacent to the perforated weeping tile shall be clean and free running. Pea Gravel shall conform to the following grading requirements:

Sieve Designation	% Passing
25 000	100
5 000	40 - 70
2 200	0 – 3

.4 Compacted Granular Fill: To City of Winnipeg Construction Specification CW 3110.

.5 Filter Fabric: Non-woven pervious geotextile fabric of polypropylene, nylon or polyester fibres or a combination.

.1 In accordance with ASTM D 4759 with the following performance criteria:

.1 Grab Tensile Strength: 100 lb in accordance with ASTM D 4632

.2 Apparent Opening Size: #100 U.S. Standard sieve in accordance with ASTM D 4751.

.3 Permeability: 150 gallons per minute per square foot in accordance with ASTM D 4491.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

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

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

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

3.2 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.3 EXAMINATION

.1 Locate all underground services and above ground utilities and protect throughout construction.

3.4 PREPARATION/PROTECTION

.1 Protect existing features.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect.

.4 Protect natural and man-made features required to remain undisturbed.

.5 Protect buried services that are required to remain undisturbed.

3.5 STOCKPILING

.1 Stockpile fill materials in areas designated by the Contract Administrator

.1 Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

3.6 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions shown on Drawings.

.2 Remove concrete, masonry, paving, walks, rubble and other obstructions encountered during excavation ands scheduled for removal in accordance with Section 02 41 19 - Selective Demolition.

.3 Excavation must not interfere with bearing capacity of adjacent foundations.

.4 Keep excavated and stockpiled materials safe distance away from edge of trench.

.5 Dispose of surplus and unsuitable excavated material off site.

.6 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.7 Notify the Contract Administrator when bottom of excavation is reached.

.8 Obtain Contract Administrator approval of completed excavation.

.9 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth.

.10 Correct unauthorized over-excavation as follows:

.1 Fill with backfill compacted to not less than 95% of corrected Standard Proctor maximum dry density.

.11 Hand trim, make firm and remove loose material and debris from excavations.

.1 Where material at bottom of excavation is disturbed, compact soil to density at least equal to undisturbed soil.

.12 Protect excavations by shoring, bracing, sheet piling, underpinning or other methods required to prevent cave-in or loose soil from falling into excavation.

.13 Protect bottom of excavations and soil adjacent to and beneath grade beam from frost.

.14 Grade excavation top perimeter to prevent surface water run-off into excavation.

3.7 FILL AND COMPACTION

.1 Use types of fill as shown on Drawings.

.2 Ensure areas to be filled are free from debris, snow, ice and water and that the ground surfaces and fill materials are not in a frozen condition.

.3 Perform all necessary compaction of existing sub-grade surfaces if densities are not equal to that required for backfill materials.

.1 Compact to 95% of corrected maximum dry density.

.4 Cut out “soft” areas of existing sub-grade, replace with fill and compact to required density.

.5 Fill areas to rough grades, contours, levels and elevations to match condition prior to start of work.

.6 Perform fill operations systematically and as early as possible to allow maximum time for natural settlement and compaction.

.7 Place and compact fill materials in continuous layers not exceeding 8" loose depth. Use a method so as not to disturb or damage mechanical and electrical service, foundation wall insulation, waterproofing and weeping tile system.

.8 Maintain optimum moisture content of fill materials so as to attain required compaction density.

.9 Grade fill in accordance with Section 31 22 13 – Rough Grading.

3.8 COMPACTED GRANULAR BASE

.1 In accordance with City of Winnipeg Specification CW 3110.

3.9 TRENCHES

.1 Excavation:

.1 Cut trenches in subgrade as shown on Drawings.

.2 Shape bed true to grade and to provide continuous, uniform bearing surface for piping.

.3 Shape transverse depressions, as required, to suit joints.

.2 Filling:

.1 Upon completion of pipe laying install pea gravel material as indicated and geotextile filter, surround and cover piping as indicated.

.1 Place by hand in maximum of 6" lifts simultaneously on each side of the piping.

.2 Consolidate by hand tamping to prevent displacement of pipe.

.2 Place granular bedding materials in uniform layers not exceeding 6" compacted thickness to depth as indicated.

.3 Compact each layer full width of bed to at least 95% of Standard Proctor density.

3.10 DEWATERING

.1 Keep crawl space free of water while work is in progress, ensure sump pits, pumps not obstructed, damaged.

3.11 RESTORATION

.1 Upon completion of Work, remove waste materials and debris.

.2 Clean and reinstate areas affected by Work.

.3 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Requirements and procedures for installing precast concrete unit pavers for access walkways within crawlspace.

1.2 RELATED SECTIONS

.1 Section 07 26 00 – Vapour Retarders.

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM C165 - 07(2017), Standard Test Method for Measuring Compressive Properties of Thermal Insulations.

.2 ASTM C303 - 10(2016)e1, Standard Test Method for Dimensions and Density of Preformed Block and Board–Type Thermal Insulation.

.3 ASTM C518 – 17, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.4 ASTM C665 – 17, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.5 ASTM C795 - 08(2018), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.6 ASTM E96 / E96M – 16, Standard Test Methods for Water Vapor Transmission of Materials.

.2 Canadian Standards Association (CSA International).

.1 CSA A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Method of Test for Concrete.

.2 CSA A179-14 (R2019), Mortar and Grout for Unit Masonry.

.3 CSA-A231.1:19/A231.2:19, Precast Concrete Paving Slabs/Precast Concrete Pavers.

.3 Underwriters Laboratories of Canada (ULC).

.1 CAN/ULC S701-11, standard for Thermal Insulation, Polystyrene, boards and Pipe Covering.

Part 2 Products

2.1 CONCRETE PAVERS

.1 Concrete pavers: to CSA-A231.2 and as follows:

.1 Size: 30” x 30” mm x 1½” height.

.2 Shape: Square.

.3 Colour: Grey.

2.2 BEDDING MATERIAL

.1 Bedding sand: clean, non-plastic, free from deleterious or foreign matter, natural or manufactured from crushed rock or gravel. Do not use limestone screenings or stone dust.

.1 Gradation: to CSA-A23.1, Table 4 - Grading Limits for Fine Aggregate, and CSA A179 as follows:

Sieve Designation	% Passing
10 mm	100
5 mm	95-100
2.5 mm	80-100
1.25 mm	50-90
630 microns	25-65
315 microns	10-35
160 microns	2-10

.2 Rigid Insulation: Rigid stonewool insulation board to CANULC-S702.

.1 Performance criteria:

.1 Flame spread index: 0 (Can/ULC S102).

.2 Density: 8 lbs/ft^3 (ASTM C303).

.3 Corrosion resistance: To ASTM C795 and ASTM C665.

.4 Thermal resistance: 4.2 hr.ft2/Btu (ASTM C518).

.5 Vapour transmission: 31 perms (ASTM E96).

.6 Compressive strength: 439 psf (ASTM C165).

.7 Thickness: 1.5 inches.

.2 Acceptable product:

.1 Comfortboard 80 as manufactured by Rockwool.

.2 Substitutions will be considered in accordance with Bidding Procedures B7 - Substitutes.

2.3 CLEANING COMPOUND

.1 Clear, organic solvent, designed and recommended by manufacturer for cleaning concrete pavers of contamination encountered.

.2 Acid based chemical detergent, designed and recommended by manufacturer for removal of contamination encountered on pavers.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 STRUCTURAL SURFACE

.1 Verify that structural surfaces conform to levels required for installation of unit pavers.

.2 Ensure that structural surface is not frozen or standing water is present during installation.

3.3 PROTECTION

.1 Protect vapour retarder during paver installation.

.2 Repair damage to vapour retarder in accordance with Section 07 26 00 – Vapour retarders.

.3 Remove protection following paver installation.

3.4 PLACING OF BEDDING MATERIAL

.1 Sand Base:

.1 Ensure bedding sand is not saturated or frozen at all times until installation is complete.

.2 Spread and screed sand over vapour retarder:

.1 Only as required to level rigid insulation over vapour retarder covered crawlspace graded fill.

.2 To width of walkway only.

.3 As shown on Drawings.

.2 Rigid Insulation:

.1 Place rigid insulation:

.1 Directly over:

.1 Vapour retarder, or

.2 Sand bed, where installed.

.2 To width of paver walkway.

3.5 INSTALLATION OF CONCRETE PAVERS

.1 Lay pavers to pattern indicated.

.2 Joints between pavers: as recommended by manufacturer.

.3 Inspect, remove, and replace chipped, broken and damaged pavers.

3.6 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Supply and installation of foundation drainage to crawlspace as shown on Drawings.

1.2 RELATED SECTIONS

.1 Section 07 26 00 – Vapour Retarders.

.2 Section 22 10 00 – Plumbing Piping.

.3 Section 22 42 01 – Plumbing Specialties.

.4 Section 31 22 13 – Rough Grading.

.5 Section 31 23 00 – Excavation and Fill.

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM D 4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

.2 ASTM D 4751, Standard Test Methods for Determining Apparent Opening Size of a Geotextile.

.3 ASTM D 4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

.4 ASTM F667 / F667M – 16, Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings.

.5

.2 Standard Council of Canada (CGSB)

1.4 PROTECTION

.1 Keep crawl spaces clean, free of standing water, and loose soil.

.2 Protect buried services that are required to remain undisturbed.

.3 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.

Part 2 Products

2.1 MATERIALS

.1 Weeping Tile:

.1 Corrugated heavy duty pipe to:

.1 ASTM F405.

.2 ASTM F667.

.2 Perforated: At locations shown on Drawings.

.3 Non-perforated: At locations shown on Drawings.

.4 Accessories: Fittings by same manufacturer as pipe.

.5 Size: as shown on Drawings.

.6 Filter sock:

.1 Manufacturer’s standard filter sock compatible with weeping tile.

.2 At locations shown on Drawings.

.2 Filter Fabric: In accordance with Section 31 23 00 – Excavation and Fill.

.3 Backfill Materials: In accordance with Section 31 23 00 – Excavation and Fill.

.4 Vapour Retarder: In accordance with Section 07 26 00 – Vapour Retarders.

.5 Sump Pit: In accordance with Section 22 42 01 – Plumbing Specialties.

.6 Sump Pit Discharge Piping: In accordance with Section 22 10 00 – Plumbing Piping.

Part 3 Execution

3.1 EXAMINATION

.1 Complete excavation, backfilling and rough grading in accordance with:

.1 Section 31 22 13 – Rough Grading.

.2 Section 31 23 00 – Excavation and Fill.

.2 Cut trenches for weeping tile as shown on Drawings and in accordance with Section 31 23 00 – Excavation and Fill.

.3 Ensure improper slopes, unstable areas, areas requiring additional compaction or other unsatisfactory conditions are corrected to approval of Consultant.

.4 Advise Consultant of timing for inspection drain tile installation before backfilling.

3.2 PIPE OR TUBING INSTALLATION

.1 Ensure tubing interior and coupling surfaces are clean before laying.

.2 Review condition of filter sock. Do not install weeping tile with ripped or damaged filter sock. Replace all damaged lengths of filter sock.

.3 Grade bedding to establish tubing slope. Do not use shims to establish slope.

.4 Lay perforated tubing to slope of minimum 2%. Face perforations and coupling slots downward.

.5 Lay non-perforated tubing as indicated, from perforated tubing to disposal area.

.1 Use compatible couplings from weeping tile manufacturer.

.2 Make joints in non-perforated tubing watertight.

.6 Install end plugs at ends of collector drains to protect tubing ends from damage and ingress of foreign material.

.7 Connect non-perforated tubing to sump pit by appropriate adapters manufactured for this purpose.

3.3 PIPE OR TUBING SURROUND MATERIAL

.1 Upon completion of tubing laying backfill trench in accordance with Section 31 23 00 – Excavation and Fill.

3.4 VAPOUR RETARDER

.1 In accordance with Section 07 26 00 – Vapour Retarders.

3.5 SUMP PITS

.1 Follow sump pit manufacturer’s specifications and recommendations for installation and connections.

.2 Install sump pit onto undisturbed soil base.

.3 All work to be carried out in accordance to City of Winnipeg Building By Law Section 23 pertaining to sump pits and pumps connecting to a subsurface drainage system. (weeping tile).

3.6 BACKFILL

.1 Place backfill material and grade in accordance with:

.1 Section 31 22 13 – Rough Grading.

.2 Section 31 23 00 – Excavation and Fill.

3.7 DEWATERING

.1 Keep crawl space free of water while work is in progress, ensure sump pits, pumps not obstructed, damaged.

END OF SECTION