

SPECIFICATION DOCUMENTS

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END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Coordination Work and Project Conditions
- .2 Start-up Meeting.
- .3 On-Site Documents.
- .4 Construction Progress Schedule
- .5 Construction Progress Meetings
- .6 Site Foreman
- .7 Construction Force
- .8 Quality Assurance
- .9 Products
- .10 Closeout Procedures

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 78 10 – Closeout Submittals.
- .3 Section 01 45 00 – Quality Control.

1.3 COORDINATION AND PROJECT CONDITIONS

- .1 Coordinate scheduling, submittals, use of Site, temporary utilities, construction facilities, and Work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.
- .2 Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- .3 Coordinate space requirements, supports, and installation of mechanical and electrical Work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- .4 In finished areas, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- .5 Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion.

- .6 After City occupancy of premises, coordinate access to Site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of City's activities.

1.4 START-UP MEETING

- .1 Within fifteen (15) days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Senior representatives of the City, Consultant, and Contractor, major Subcontractors, field inspectors and are to be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum five (5) days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include following:
 - .1 Appointment of official representative of participants in Work.
 - .2 Schedule of Work.
 - .3 Schedule of submission of Shop Drawings, samples and colour chips as specified in Section 01 33 00 – Submittal Procedures.
 - .4 Delivery schedule of specified equipment.
 - .5 SITE safety and security.
 - .6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.
 - .7 City-furnished Products (if applicable).
 - .8 Monthly progress claims, administrative procedures, photographs, and holdbacks.
 - .9 Insurances and transcript of policies.
- .6 Comply with Transit's allocation of mobilization areas of Site; for field offices and sheds, access, traffic, and parking facilities.
- .7 During construction, coordinate use of Site and facilities through Consultant's procedures for intra-project communications: Submittals, reports and records, schedules, coordination of Drawings, recommendations and resolution of ambiguities and conflicts.
- .8 Comply with instructions of Consultant for use of temporary utilities and construction facilities.
- .9 Coordinate field engineering and layout work with Consultant.

1.5 ON-SITE DOCUMENTS

- .1 Maintain at job Site, one (1) copy each of the following:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.

- .4 Reviewed Shop Drawings.
- .5 Change orders.
- .6 Other modifications to Contract.
- .7 Field test reports.
- .8 Copy of approved Work schedule.
- .9 Manufacturers' installation and application instructions.
- .10 Labour conditions and wage schedules.
- .11 Applicable current editions of municipal regulations and by-laws. Current building codes, complete with addenda bulletins applicable to the Place of the Work.

1.6 CONSTRUCTION PROGRESS SCHEDULE

- .1 Submit preliminary construction progress schedule to Consultant which is coordinated with Consultant's project schedule.
- .2 After review, revise and resubmit schedule to comply with revised project schedule.
- .3 During progress of Work revise and resubmit as directed by Consultant.

1.7 CONSTRUCTION PROGRESS MEETINGS

- .1 Schedule and administer bi-weekly project meetings throughout progress of Work or as determined by Consultant.
- .2 Attendance Required: Job superintendent, major Subcontractors and suppliers, City, Consultant, as appropriate to agenda topics for each meeting.
- .3 Prepare Agenda as follows:
 - .1 Review minutes of previous meetings.
 - .2 Review of Work progress.
 - .3 Field observations, problems, and decisions.
 - .4 Identification of problems which impede planned progress.
 - .5 Review of submittals schedule and status of submittals.
 - .6 Review of off-Site fabrication and delivery schedules.
 - .7 Review construction schedule and corrective measures to regain projected schedules.
 - .8 Planned progress during succeeding work period.
 - .9 Maintenance of quality and work standards.
 - .10 Effect of proposed changes on progress schedule and completion date.
 - .11 Other business relating to Work.
- .4 Record Minutes including significant proceedings, decisions and required action by the affected parties within three (3) days after meeting. Distribute copies to Contractor, City, participants and those affected by decisions made.

1.8 SUBMITTALS

- .1 Prepare and issue submittals to Consultant for review as per requirements of section 01 33 00 – Submittals.

1.9 SITE FOREMAN

- .1 A full-time (on-Site) foreman shall be employed for the duration of the project and shall be on the job during all working periods. Upon request, the Contractor shall provide written evidence of his qualifications, competence and experience, including a list of similar projects completed under his personal direction.
- .2 Particular emphasis shall be placed on the foreman's ability to co-ordinate trades and maintain the schedules required to perform the work.
- .3 The City reserves the right to request an alternative foreman if project co-ordination is unsatisfactory.

1.10 CONSTRUCTION FORCE

- .1 The Contractor shall provide and maintain a sufficient crew of labourers, mechanics, and foremen to perform the Work at all times during the performance of the Contract.
- .2 The City reserves the right to request that additional forces be provided to meet project schedule.

1.11 QUALITY ASSURANCE - CONTROL OF INSTALLATION

- .1 Refer to section 01 45 00 – Quality Control.

1.12 PRODUCTS

- .1 Do not use materials, Products or equipment removed from existing premises, except as specifically permitted by the Contract Documents. Co-ordinate with City before discarding existing equipment.
- .2 Provide interchangeable components of the same manufacture for components being replaced.

1.13 CLOSEOUT PROCEDURES

- .1 Notify Consultant when Work is considered ready for Substantial Performance.
- .2 Accompany Consultant on preliminary inspection to determine items listed for completion or correction.
- .3 Comply with Consultant's instructions for correction of items of Work listed in executed certificate of Substantial Performance and for access to City-occupied areas.
- .4 Notify Consultant of instructions for completion of items of Work determined in Consultant's final inspection.
- .5 Refer to section 01 78 10 – Closeout Submittals, for requirements.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Submittal procedures.
- .2 Shop Drawings and Product data.
- .3 Submittal checklist

1.2 RELATED SECTIONS

- .1 Section 01 78 10 – Closeout Submittals

1.3 SUBMITTAL PROCEDURES

- .1 Submit to Consultant 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.
- .2 Work affected by submittal shall not proceed until review is complete.
- .3 Present Shop Drawings, product data, samples and mock-ups in SI Metric & Imperial inch-pound in brackets units.
- .4 Where items or information is not manufactured or produced in SI Metric units, converted values within the metric measurement tolerances are acceptable.
- .5 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.
- .6 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.
- .7 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .8 Verify field measurements and affected adjacent Work are coordinated.
- .9 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.
- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.
- .11 Keep one (1) reviewed copy of each submission on SITE.

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 Refer to GC 3.11.

- .2 The term "Shop Drawings" means Drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by the Contractor to illustrate details of a portion of the Work.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Contractor is responsible to field verify all dimensions of new components (ie. coils, fin tube, reheat coils, convectors), which integrate with existing Site and equipment conditions, before processing Shop Drawings. Should dimensions conflict with Site conditions, request clarification from Consultant before proceeding. The City will not be responsible for replacing ordered components which do not fit the Site conditions.
- .5 Allow ten (10) days for Consultant's review of each submission.
- .6 Adjustments made on Shop Drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.
- .7 Make changes in Shop Drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of 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 Consultant's review, distribute copies.
- .11 Submit six (6) prints or electronic copy of Shop Drawings for each requirement requested in specification Sections and as consultant may reasonably request.
- .12 Submit six (6) copies or electronic copy of product data sheets or brochures for requirements requested in specification sections and as requested by Consultant where Shop Drawings will not be prepared due to standardized manufacture of product.
- .13 Delete information not applicable to project.
- .14 Supplement standard information to provide details applicable to project.
- .15 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, print copies or 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.

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.

1.6 SUBMITTAL CHECKLIST

- .1 The following is a list of documents that are required to finalize this contract:
 - .1 Statutory Declaration that all debts associated with the Contract have been paid.
 - .2 A letter from the Worker's Compensation Board indicating the status of the Contractor.
 - .3 Transcription of insurance immediately after award of Contract.
 - .4 Operation & Maintenance Manual and Parts List for all equipment.
 - .5 "As-built" record drawings and documents showing revisions to the system made during construction.
 - .6 DDC printout showing all setpoints and settings with present operating conditions including all alarm setpoints and sensor locations.
 - .7 Valve tag directory.
 - .8 Certificate indicating factory start-up of major equipment.
 - .9 Electrical inspection certificate from the electrical power authority.

- .10 Mechanical and electrical inspection certificates from the authorities having jurisdiction.
- .11 Warranties and bonds fully executed and notarized.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Inspection and testing, administrative and enforcement requirements.
- .2 Written and electronic reports.
- .3 Testing requirements for equipment and systems.
- .4 Quality Assurance

1.2 REFERENCES

- .1 ISO/IEC 17025:2005 – General Requirements for the Competence of Testing and Calibration Laboratories.
- .2 SCC (Standards Council of Canada).

1.3 INSPECTION BY AUTHORITY

- .1 Allow Authorities Having Jurisdiction 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 whenever portions of the Work are designated for special tests, inspections or approvals, either when described in the Contract Documents or when required by law in the Place of the 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.

1.4 REVIEW BY CONSULTANT

- .1 Consultant may order any part of the Work to be reviewed or inspected if Work is suspected to be not in accordance with Contract Documents.
- .2 If, upon review such work is found not in accordance with Contract Documents, correct such Work and pay cost of additional review and correction.
- .3 If such Work is found in accordance with Contract Documents, City will pay cost of review and replacement.

1.5 INDEPENDENT INSPECTION AGENCIES

- .1 Employment of inspection and testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .2 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant at no cost to City. Pay costs for retesting and re-inspection.

1.6 ACCESS TO WORK

- .1 Allow inspection and testing agencies access to Work, off Site manufacturing and fabrication plants.

- .2 Cooperate to provide reasonable access and facilities for such access.

1.7 PROCEDURES

- .1 Notify appropriate agency in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay 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.

1.8 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 Consultant 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 Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, City may deduct from Contract Price the difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Consultant.

1.9 REPORTS

- .1 Submit one (1) printed copy or electronic copy of signed inspection and test reports to Consultant.
- .2 Provide signed paper copies to Subcontractor(s) of work being inspected or tested

1.10 TESTING REQUIREMENTS FOR EQUIPMENT AND SYSTEMS

- .1 Submit Testing report(s) for mechanical, electrical and building equipment systems.
- .2 Plumbing and Drainage shall be tested in conformance with the Plumbing Code of Canada.

1.11 QUALITY ASSURANCE – CONTROL OF INSTALLATION

- .1 Monitor quality control over suppliers, manufacturers, Products, services, Site conditions, and workmanship, to produce Work of specified quality.
- .2 Comply with manufacturers' instructions, including each step in sequence.
- .3 Should manufacturers' instructions conflict with Contract Documents, request clarification from Consultant before proceeding.
- .4 Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

- .5 Perform Work by persons qualified to produce required and specified quality. Employ only tradesmen holding valid Provincial Trade Qualification certificates.
- .6 Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- .7 Contractor is responsible to field verify all dimensions of new components (ie. preheat coils, fin tube, reheat coils, convectors), which integrate with existing SITE and equipment conditions, before processing shop drawings. Should dimensions conflict with SITE conditions, request clarification from Consultant before proceeding. **The City will not be responsible for replacing ordered components which do not fit the SITE conditions.**
- .8 Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
- .9 No part of the building structure shall be loaded during construction with a load greater than it can bear safely when completed. The Contractor shall notify the Consultant if there is any question on the load bearing capacities of the structure. The Contractor shall be liable for any damage resulting from any violation of this requirement.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Product quality, availability, storage, handling, protection, and transportation.
- .2 Product substitution procedures.
- .3 Manufacturer's instructions.
- .4 Quality of Work, coordination and fastenings.
- .5 Existing facilities.

1.2 RELATED SECTIONS

- .1 01 31 00 – Project Managing and Coordination.

1.3 TERMINOLOGY

- .1 New: Produced from new materials.
- .2 Renewed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.
- .3 Defective: A condition determined exclusively by the Consultant.

1.4 PRODUCT QUALITY

- .1 Products, materials, equipment, parts or assemblies incorporated in Work: New, not damaged or defective, of best quality 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 Consultant.
- .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.

1.5 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 Consultant 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 Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available Products of similar character, at no increase in Contract Price or Contract Time.

1.6 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 Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- .7 Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- .8 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

1.7 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.

1.8 PRODUCT CHANGES

- .1 Change in Product/Products: Submit request for substitution or alternative in accordance with Section 01 62 00 – Product Exchange Procedures.

1.9 MANUFACTURER'S WRITTEN INSTRUCTIONS

- .1 Unless otherwise indicated in 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 Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Consultant may establish course of action.
- .3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes Consultant to require removal and re-installation at no increase in Contract Price or Contract Time.

1.10 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Consultant if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Consultant reserves right to require dismissal from SITE any workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Consultant, whose decision is final.

1.11 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.

1.12 CONCEALMENT

- .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation, inform Consultant if there is interference. Install as directed by Consultant.

1.13 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.

1.14 LOCATION OF FIXTURES

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

1.15 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.

1.16 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.

1.17 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 Consultant.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Substitutions.
- .2 Alternatives.
- .3 Separate prices.

1.2 RELATED SECTIONS

- .1 The City of Winnipeg Bid Opportunity Document

1.3 SUBSTITUTIONS

- .1 Instructions to Bidders specify time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this section.
- .2 Substitutions after contract award will not be acceptable unless approved by the Consultant.
- .3 Substitutions may be considered by the Consultant when a Product becomes unavailable through no fault of the Contractor.
- .4 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- .5 A request constitutes a representation that the Contractor:
 - .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 City.
 - .4 Waives claims for additional costs or time extension which may subsequently become apparent.
 - .5 Will reimburse City and Consultant 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.
- .7 Substitution Submittal Procedure:
 - .1 Submit one copy, in electronic format, of request for Substitution for consideration. Limit each request to one (1) proposed Substitution.
 - .2 Submit Shop Drawings, product data, and certified test results attesting to the proposed Product equivalence. Burden of proof is on proposer.
 - .3 The Consultant will notify Contractor in writing of decision to accept or reject request.

1.4 ALTERNATIVES

- .1 Accepted Alternatives will be identified in City-Contractor Agreement.
- .2 In submission of alternatives to products specified, bidders shall include in their bid, any changes required in the Work to accommodate such alternatives. A later claim by the bidder for an addition to the Contract Price because of changes in work necessitated by use of alternatives shall not be considered.
- .3 The submission shall provide sufficient information to enable the Consultant to determine acceptability of such products.
- .4 Provide complete information on required revisions to other work to accommodate each alternative, the dollar amount of additions to or reductions from the Bid Price, including revisions to other work. Submit on Bid Form in Part A-Bid Submission.
- .5 Alternatives quoted on Bid Forms will be reviewed and accepted or rejected at the City's option. Accepted alternatives will be identified in the City-Contractor Agreement.
- .6 Coordinate related work and modify surrounding work to integrate the Work of each alternative.
- .7 Schedule of Alternatives: Refer to Part D-Schedule of Work for description of requested alternatives.
- .8 Unless alternatives are submitted in this manner and subsequently accepted, provide products as specified.

1.5 SEPARATE PRICES

- .1 Separate Price items do NOT replace or substitute items already in the Bid Documents. Accepted Separate Prices will be:
 - .1 identified in the Construction Agreement as an increase to the Bid Price,
or
 - .2 in a subsequent Change Order.
- .2 Submit Separate Prices to identify items that may be added to the Contract, at the City's option. Include in the quoted Separate Price, overhead and profit, the effect on adjacent or related components already in the Work described in the Bid Documents.
- .3 Coordinate related Work and modify surrounding Work to integrate the work of each Separate Price.
- .4 Schedule of Separate Prices: Refer to Part A-Bid Submission for description of requested separate prices.

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 City or other Contractors or their employees.
- .2 Remove waste materials from SITE at daily regularly scheduled times or dispose of as directed by Consultant.
- .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 City or other Contractors or their employees.
- .5 Remove waste materials from Site at regularly scheduled times or dispose of as directed by Consultant.

- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Clean and polish mechanical and electrical fixtures.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .12 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .13 Remove dirt and other disfiguration from exterior surfaces.
- .14 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .15 Sweep and wash clean paved areas. Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .16 Clean roofs, downspouts, and drainage systems.
- .17 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

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 DEFINITIONS

- .1 Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.
- .2 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .3 Recycling: Process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .4 Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .5 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .6 Separate Condition: Refers to waste sorted into individual types.
- .7 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.

1.2 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner or similar material into waterways, storm, or sanitary sewers.
- .3 Remove materials from demolition as Work progresses.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 APPLICATION

- .1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
- .2 Prior to disposal of removed equipment and materials confirm with Transit Facility Manager if product is to be turned over to Transit.

3.2 CLEANING

- .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Inspections and declarations.
- .2 Closeout submittals
- .3 Operation and maintenance manual format.
- .4 Contents each volume.
- .5 Recording actual Site conditions.
- .6 Record (as-built) documents and samples.
- .7 Record documents.
- .8 Final survey.
- .9 Warranties and bonds.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 45 00 – Quality Control.
- .3 Section 01 79 00 – Demonstration and Training.

1.3 INSPECTIONS AND DECLARATIONS

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Consultant in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Consultant's Inspection.
- .2 Consultant's Inspection: Consultant and Contractor will perform inspection of Work to identify defects or deficiencies. Correct defective and deficient Work accordingly.
- .3 Completion: Submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested adjusted, balanced, commissioned and are fully operational.
 - .4 Certificates required by authorities having jurisdiction have been submitted.
 - .5 Operation of systems have been demonstrated to City's personnel.
 - .6 Work is complete and ready for Final Inspection.

- .4 Final Inspection: When items noted above are completed, request final inspection of Work by Consultant and Contractor. If Work is deemed incomplete by City or Consultant, complete outstanding items and request re-inspection.
- .5 Declaration of Substantial Performance: when Consultant considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Substantial Performance of the Work.
- .6 Commencement of Warranty Periods: the date of Substantial Performance of the Work shall be the date for commencement of the warranty period.
- .7 Commencement of Lien Periods: the date of publication of the certificate of Substantial Performance of the Work shall be the date for commencement of the lien period, unless required otherwise by the lien legislation applicable at the Place of the Work.
- .8 Final Payment: When Consultant considers final deficiencies and defects have been corrected and it appears requirements of Contract have been completed, make application for final payment.
- .9 Payment of Hold-back: After issuance of certificate of Substantial Performance of the Work, submit an application for payment of hold-back amount.

1.4 CLOSEOUT SUBMITTALS

- .1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection with Consultant's comments.
- .3 Revise content of documents as required prior to final submittal.
- .4 Two (2) weeks prior to Substantial Performance of the Work, submit to the Consultant, three (2) final copies of operating and maintenance manuals in Canadian 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.

1.5 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 8.5 x 11 inch 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.
- .9 Submit one (1) draft copy of completed volumes fifteen (15) days prior to final inspection. This copy will be reviewed and returned after final inspection, with Consultant comments. Revise content of all document sets as required prior to final submission.
- .9 Submit two sets of revised final volumes, within ten (10) days after final inspection.
- .10 Provide one electronic copy of drawings in AutoCAD format if possible.

1.6 CONTENTS – EACH VOLUME- O & M

- .1 Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, typed on 20 lb white paper, in three (3) parts as follows:
 - .1 Part 1: Directory, listing names, addresses, and telephone numbers of Consultant, Contractor, Subcontractors, and major equipment suppliers.
 - .2 Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - .1 Significant design criteria.
 - .2 List of equipment.
 - .3 Parts list for each component.
 - .4 Operating instructions.
 - .5 Maintenance instructions for equipment and systems.
 - .3 Project documents and certificates, including the following:
 - .1 Shop Drawings and product data.
 - .2 Air and water balance reports.
 - .3 Certificates.
 - .4 Photocopies of warranties.
- .2 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .3 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including code compliance certificate, life safety systems performance certificate, hydronic pressure test certificate, and commissioning certificate.

- .4 Training: Refer to Section 01 79 00 – Demonstration and Training.

1.7 EQUIPMENT AND SYSTEMS – O & M

- .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 Include test reports as specified in Section 01 45 00 – Quality Control.
- .15 Additional requirements: As specified in individual specification sections.

1.8 MATERIALS AND FINISHES – O & M

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition and colour and texture designations.
- .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 Building Envelope: include copies of Drawings of building envelope components, illustrating the interface with similar or dissimilar items to provide an effective air, vapour and thermal barrier between indoor and outdoor environments. Include an outline of requirements for regular inspections and for regular maintenance to ensure that on-going performance of the building envelope will meet the initial building envelope criteria.
- .5 Additional Requirements: as specified in individual specifications sections.

1.9 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings, and within the Project Manual, provided by Consultant.
- .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 depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: Maintain manufacturer's certifications, inspection certifications, field test records required by individual specifications sections.

1.10 RECORD (AS-BUILT) DOCUMENTS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the Site for Consultant and City, one (1) 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 the 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 Consultant.
- .6 Submit final as-built documents (hard copy of drawings and specs) to the Consultant. The Consultant will make changes to the electronic set of record drawings and specifications.

1.11 FINAL SURVEY

- .1 Not applicable.

1.12 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 (10) days after completion of the applicable item of work.
- .4 Except for items put into use with 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 submittals.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 Demonstrate operation and maintenance of equipment and systems to City's personnel two (2) weeks prior to date of final inspection.
- .2 City will provide list of personnel to receive instructions, and will co-ordinate their attendance at agreed-upon times.

1.2 QUALITY CONTROL

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

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit reports within one (1) week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .3 Give time and date of each demonstration, with list of persons present.

1.4 CONDITIONS FOR DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation in accordance with Division 23.
- .2 Testing and adjusting has been performed and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.5 PREPARATION

- .1 Verify that conditions for demonstration and instructions comply with requirements.
- .2 Verify that designated personnel are present.

1.6 DEMONSTRATION AND INSTRUCTIONS

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location.
- .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
- .3 Review contents of manual in detail to explain aspects of operation and maintenance.
- .4 Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

1.7 TIME ALLOCATED FOR INSTRUCTIONS

- .1 Ensure amount of time required for instruction of each item of equipment or system as follows:
 - .1 Division 11 – Vehicle Washing Equipment: four (4) hours of instruction 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 REFERENCES

- .1 Export and Import of Hazardous Waste Regulations SOR/2002-300.
- .2 National Fire Code of Canada.
- .3 Transportation of Dangerous Goods Act (TDG Act), (c. 34).
- .4 Transportation of Dangerous Goods Regulations T-19.01-SOR/2003-400.

1.2 DEFINITIONS

- .1 Dangerous Goods: product, substance, or organism that is specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
- .2 Hazardous Material: product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals or plant life when released into the environment.
- .3 Hazardous Waste: any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.
- .4 Workplace Hazardous Materials Information System (WHMIS): a Canada-wide system designed to give employers and workers information about hazardous materials used in workplace. Under WHMIS, information on hazardous materials is provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by combination of federal and provincial laws.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit to Consultant current Material Safety Data Sheet (MSDS) for each hazardous material required prior to bringing hazardous material on Site.

1.4 STORAGE AND HANDLING

- .1 Co-ordinate storage of hazardous materials with Consultant and abide by internal requirements for labelling and storage of materials and wastes.
- .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes and guidelines.
- .3 Store and handle flammable and combustible materials in accordance with current National Fire Code of Canada requirements.

- .4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.
 - .1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.
 - .2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Consultant.
- .5 Transfer of flammable and combustible liquids is prohibited within buildings.
- .6 Do not transfer of flammable and combustible liquids in vicinity of open flames or heat-producing devices.
- .7 Do not use flammable liquids having flash point below 38 degrees Celsius, such as naphtha or gasoline as solvents or cleaning agents.
- .8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
- .9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.
- .10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
 - .1 Store hazardous materials and wastes in closed and sealed containers.
 - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
 - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
 - .4 Segregate incompatible materials and wastes.
 - .5 Ensure that different hazardous materials or hazardous wastes are not mixed.
 - .6 Store hazardous materials and wastes in secure storage area with controlled access.
 - .7 Maintain clear egress from storage area.
 - .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
 - .9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.
 - .10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.
- .11 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements. Report spills or accidents immediately to Consultant. Submit a written spill report to Consultant within twenty-four (24) hours of incident.

1.5 TRANSPORTATION

- .1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
- .2 If hazardous waste is generated on Site:
 - .1 Co-ordinate transportation and disposal with Consultant.
 - .2 Ensure compliance with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.
 - .3 Use licensed carrier authorized by provincial authorities to accept subject material.
 - .4 Prior to shipping material obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept this material.
 - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
 - .6 Ensure that trained personnel handle, offer for transport, or transport dangerous goods.
 - .7 Provide photocopy of shipping documents and waste manifests to Consultant.
 - .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide a photocopy of completed manifest Consultant.
 - .9 Report discharge, emission, or escape of hazardous materials immediately to Consultant and appropriate provincial authority. Take reasonable measures to control release.

Part 2 Products

2.1 MATERIALS

- .1 Only bring on Site quantity of hazardous materials required to perform Work.
- .2 Maintain MSDSs in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 DISPOSAL

- .1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
- .2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.
- .3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.

- .4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.
- .5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.
- .6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.
- .7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.
- .8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:
 - .1 Hazardous wastes recycled in manner constituting disposal.
 - .2 Hazardous waste burned for energy recovery.
 - .3 Lead-acid battery recycling.
 - .4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 19 – Construction/Demolition Waste Management and Disposal.
- .3 Section 01 78 00 – Closeout Submittals.
- .4 Section 26 05 01 – Common Work Results – Electrical.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A653/A653M-01a, Standard Specification for Steel Sheet, Zinc-Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM D1854, Standard Specification for Jet-Fuel-Resistant Concrete Joint Sealer, Hot-Poured Elastic Type.
 - .3 ASTM D3405, Standard Specification for Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements.
 - .4 ASTM D3569, Standard Specification for Joint Sealant, Hot-Applied, Elastomeric Jet-Fuel-Resistant for Portland Cement Concrete Pavements.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.59, Alkyd, Exterior Gloss Enamel.
 - .2 CAN/CGSB-1.81, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
 - .3 CAN/CGSB-1.104, Semi-gloss Alkyd Air Drying and Baking Enamel.
 - .4 CAN/CGSB-1.189, Exterior Alkyd Primer For Wood.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA W59, Welded Steel Construction (Metal Arc Welding) (Imperial Version).
- .4 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual.
- .5 Transportation Association of Canada (TAC)
 - .1 Manual of Uniform Traffic Control Devices for Canada.

1.3 SYSTEM OPERATION AND PERFORMANCE

- .1 Operation mode – Transit Bus Wash

- .1 The vehicle enters the wash lane, at a speed of 1.5 km/h, and breaks the photo eye beam in front of the chemical application arch and receives full soap on front, sides and rear.
 - .2 As the soap is being applied to the vehicle the brushes of the Brush Module begin to spin and the rear brushes remain in the retracted position.
 - .3 The roof of the vehicle is washed as the vehicle is driving through the roof mop structure.
 - .4 Two (2) brush arms are mounted on one (1) common column on each side of the wash bay. The brushes closest to the exit of the wash lane will wash the sides only while the brushes closest to the entrance of the wash lane will wash the sides and the rear of the vehicle. At no time does the vehicle need to stop for the brushes to wash the vehicle.
 - .5 When the vehicle breaks the second photo eye beam, this will activate the High Pressure Front Blaster Arch which will allow the washing of the front of the vehicle using high pressure water. The pump system will produce 110 GPM at 340 PSI. Once the front corner of the vehicle reaches a predetermined point the high pressure will be switched over to the wheel/rocker panel and undercarriage blasters. Once the vehicle has cleared the arch the high pressure water pump will be switched off.
 - .6 When the vehicle breaks the photo eye system used to activate the Final Rinse Arch the arch activates. The arch continues to rinse the vehicle until five (5) seconds after the beam of the activation photo eye system is re-established.
 - .7 The wash equipment must be capable of washing up to a minimum of forty-five (45) vehicles per hour satisfactorily. The vehicle wash system shall be able to remove the visible heavy dirt accumulation and the road film from the vehicles when they are driven through the washer at a speed of 1.5 km/h.
 - .8 No acids containing fluorides (HF or ABF) shall be allowed.
 - .9 The evaluation of the system capability to remove road film shall be determined only after the vehicles have dried after the washing process has been completed.
 - .10 Under NO CIRCUMSTANCES shall the vehicle be required to stop through the wash in order for the front or the rear of the vehicle to be washed.
- .2 Operation mode-Reclaim System
- .1 Through the use of a float switch used by the reclaim system when the wash water storage tank has drop to a pre-set level the reclaim pump will turn on.
 - .2 The reclaim pump will draw water from the reclaim pit, through a stainless steel suction screen designed to prevent large items from being sucked into the pump.
 - .3 It will then push the water through the hydro-cyclone to remove particle that are 40 micron and bigger.
 - .4 The water coming out of the top of the hydro-cyclone will go back into the wash water holding tank and the effluent coming out of the bottom of

the cyclone will be sent either towards the reclaim pits or the building oil/water separator and finally to sewer.

- .5 Once the wash water holding tank is full, through the use of the high level float switch, the reclaim pump will turn off.
 - .6 After a prescribe amount of time the aeration system will turn on due to inactivity to prevent foul odors from developing. The aeration of the water can be done in all of the places listed below:
 - .1 Wash water holding tank.
 - .2 In ground reclaim pits.
 - .3 Trenches in the wash bay.
 - .7 The reclaim system will provide 220 GPM on a consistent basis.
- .3 Operation mode – Blower System
- .1 When the vehicle crosses in the beam from the final rinse photo eye a signal is given to start the final rinse as well as start the Chemical injection Station to inject a rinse aid product to permit to change the surface tension of the water allowing it to bead and be blown off by the blower system. The crossing of this beam will also begin the sequenced starting of the eight (8) separate air producers.
 - .2 The blower system shall shut down after a prescribe set of time, with the use of the photo eye installed on the final rinse arch.
 - .3 The blower system can satisfactorily dry up to a minimum of forty-five (45) vehicles per hour. The blower system shall be able to remove most of the water from the vehicles when provided they are driven through the washer at speed of 1.5 km/hr and that an adequate rinse aid is used.
 - .4 The evaluation of the system capability to remove water shall be determined only after the vehicle completed the drying cycle.

1.4 SHOP DRAWINGS

- .1 Submit Shop Drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Indicate equipment layout, mounting bolt locations, electric power requirements, sensing installation details, wiring diagrams.
- .3 Furnish catalogue description, illustration and specification data for each piece of equipment and accessory.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for equipment for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.
- .2 Conduct comprehensive demonstration and training for maintenance staff on operation and care of system.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction and Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Fold up metal banding, flatten and place in designated area for recycling.

1.7 EXTRA MATERIALS

- .1 Provide extra materials in accordance with Section 01 78 00 – Closeout Submittals.
- .2 Store where directed by Transit.

Part 2 Products

2.1 TRANSIT BUS WASH

- .1 General:
 - .1 The complete structure of the wash system will be made from galvanized structural steel.
 - .2 The wash equipment will be able to wash vehicles up to twelve (12) feet in height.
 - .3 All galvanizing will be done in accordance with ASTM A123 or A385.
 - .4 All galvanized piping, if equipped, of the wash system will be in accordance with ASTM A53.
 - .5 All PVC piping, if equipped, of the wash system will be in accordance with ASTM D1785-12 and D2467-13A.
 - .6 The starting and stopping of the equipment will be controlled by photo electric eyes or any other equivalent equipment that does not require physical contact with the vehicle being washed.
 - .7 All low points of piping must have a valve installed for drainage for maintenance purposes.
 - .8 All electrical motors must be NEMA Premium TEFC motors.
The chemical used to wash the vehicles must be a chemical used to wash vehicles using friction based method.
 - .9 Piping on all equipment can come in either Galvanized, PVC or stainless unless specifically indicated on Drawings.
 - .10 Acceptable product: Pseco or approved equal.

2.2 TRANSIT BUS WASH COMPONENTS

- .1 Entrance Slip Plates
 - .1 They are made from .25" Stainless Steel 304 plate and come with welded anchoring rods for epoxy anchoring installation.
 - .2 Two (2) Plates shall be installed at the entrance of the wash lane which will aid in repositioning any vehicle that is out of alignment with the wash lane.
- .2 Guide Rails
 - .1 The purpose of this device is to maintain the alignment of the vehicle within the wash lane as the driver drives the vehicle through the wash.
 - .2 The guide rails fabricated from 3.5" SCH 40 Pipe (4" OD). They extend the entire length of the wash system and in addition will extend not less than six (6) feet before the initial spray arch and two (2) feet beyond the final rinse arch. The guide rails must be anchored to the floor.
 - .3 The guide rails have an angled entry at the entrance. Ends of rails are capped.
Brackets supporting pipe shall be made of minimum of 3/8" steel plate that are anchor bolted to the concrete.
 - .4 All welds on the guide rail equipment must be ground smooth to prevent any tire damage to vehicles.
 - .5 Guide Rails must be hot dipped galvanized.
- .3 Chemical Application Arch:
 - .1 This piece of equipment is designed to completely cover the front, sides, rear and roof of all vehicles being washed with a water chemical mixture designed for the washing of vehicles.
 - .2 Chemical Arch(s) is made of 1" pipe compatible with detergents used and equipped with equipped with twenty-two (22) dual, adjustable spray nozzles with diaphragm check valve to evenly apply the chemical water mixture to front, rear, sides and roof of vehicle proceeding through the arch.
 - .3 The design of the detergent arch allows for immediate activation of the nozzles upon arch activation by the vehicle.
 - .4 Chemical is injected into the arch through an injection valve on the chemical application arch.
 - .5 The arch uses fresh water only at a consumption rate of 22 GPM at 50 PSI. The chemical application arch is bolted onto the roof mop structure.
 - .6 No free standing pipe arches are allowed.
 - .7 All structural components of this arch must be hot dip galvanized.
 - .8 Piping will be made from SCH 80 PVC.
- .4 Stationary Roof Mop Module:
 - .1 This device is designed to wash the roofs of the vehicles as the vehicle is driven under the roof mop.

- .2 The stationary roof mop assembly is supported by a galvanized steel structure made from 2" x 3" x .25" thick structural tubing which is properly braced to provide a firm mounting base.
 - .3 The roof mop is made up of a minimum of five (5) rows of synthetic, dirt repellent, mildew resistant fibre material all of different length for optimal roof cleaning.
 - .4 The mop is designed to wash the full roof width of the vehicles.
 - .5 A water supply consists of 1" piping equipped with eight (8) adjustable spray nozzles with diaphragm check valve.
 - .6 The roof mop is designed to deliver 8 GPM at 50 PSI.
 - .7 Piping will be made from SCH 80 PVC.
- .3 Four Brush Side and Rear Module:
- .1 The purpose of this device is to wash the Sides and Rear of each vehicle with four (4) counter rotating brushes.
 - .2 The brush module columns will be made from 10" x 10" x .25" galvanized structural steel.
 - .3 The system shall be equipped with 4 counter rotating brushes. The two (2) brushes closest to the exit, named the side bushes, of the wash lane will have limited travel and will wash the sides of the vehicle only. The two (2) brushes closest to the entrance, named the rear brushes, of the wash lane will be mobile and will be able to wash the sides as well as the rear of the vehicles in an over lapping manner.
 - .4 All brushes are made of polypropylene material and are in 7" sections. They are comprised of 0.044" X-shaped UEX (Circulex) full density material in all areas except for the window areas which will be 2/3" density. The window brushes are made from 0.044" X-shaped UEX (Circulex) half density material. The brushes shall be 60" OD. The brush motors must be a maximum of 5 HP each.
 - .5 The motion of the rear brushes is controlled via pneumatic actuators designed for a wet environment.
 - .6 Each brush assembly has its own spray pipe, which consists of 1" pipe. Each individual brush spray pipe is equipped with eight (8) adjustable spray nozzles with diaphragm check valve.
 - .7 The four (4) spray bars will deliver 32 GPM at 50 PSI.
 - .8 Spray bars will be made from SCH 80 PVC pipe.
 - .9 The main water inlet on the brush module is equipped with a detergent injection connection.
 - .10 The frame for the brush module is made from galvanized structural steel.
 - .11 The brush module must have the following safety features built in:
 - .1 Mirror avoidance program
 - .2 Over amperage protection program
- .4 Front Blaster Arch:
- .1 The arch is made from galvanized structural steel and the piping is 2" SCH 40 Galvanized Pipe. All fittings will be 300# in the same material as the pipe used.

- .2 The arch is equipped with ten (10) maintenance free spinners, five (5) per side. No special tools or adjustments are required for these spinners.
- .3 The control valves used are air operated ball valves. A pneumatic control panel is located in the wash bay.
- .5 Pump Station:
 - .1 40 HP High Pressure Pump:
 - .1 The suction line of the pump will be made from schedule 80 PVC pipe and fittings while the output line will be made from 2" SCH 40 Galvanized Pipe. All fitting will be 300# in the same material as the pipe used.
 - .2 The high pressure pump must be able to deliver 110 GPM at 340 PSI
 - .3 The pump shall be a vertical multistage close coupled in-line design constructed from 304 stainless steel.
 - .4 Suction and discharge lines must be a minimum 2.5" 300# ANSI raised face flange.
 - .5 The electric motor shall be of the squirrel cage induction type suitable for across the line starting. Motor shall operate on 600 V, 3 phase, 60 cycle and be TEFC with a 1.15 service factor.
 - .6 The motor shall be sized so as not to exceed the name plate horse power during operation. The motor shall be a maximum of 40 HP. The motor shall be certified by the manufacturer for forty-five (45) activations per hour.
 - .7 The pump motor shall have electronic soft start system.
 - .8 Pump must be equipped with a pre-set pressure relief valve and return water to the wash water storage tank.
 - .2 5 HP Wash Water Pump
 - .1 The suction and output line of the pump will be made from SCH 80 PVC pipe and fittings.
 - .2 The wash water pump must be able to deliver 50 GPM at 75 PSI
 - .3 The pump shall be a vertical multistage close coupled in-line design constructed from 304 stainless steel.
 - .4 Suction and discharge lines must be a minimum 2" 300# ANSI raised face flange.
 - .5 The electric motor shall be of the squirrel cage induction type suitable for across the line starting. Motor shall operate on 600 Volt, 3 phase, 60 cycle and be TEFC with a 1.15 service factor.
 - .6 The motor shall be sized so as not to exceed the name plate horse power during operation. The motor shall be a maximum of 5 HP.
 - .3 The system shall be equipped with 500 gallon polyethylene water holding tank equipped with high and low level float switches. The system holding tank shall be filled with either City fresh water, rain recovery water, recycled water or a combination of these options.
 - .4 The holding tank shall be filled via 2", slow closing solenoid valve activated by a high level float switch in the holding tank

.6 Final Rinse Arch:

- .1 The purpose of this device is to thoroughly rinse off the vehicle to assure that no detergent or other wash residue is remaining on the vehicle.
- .2 Final Rinse Arch is made from galvanized structural steel. The piping is made from 1.5" pipe and equipped with twenty-two (22) pieces of dual, adjustable spray nozzles with diaphragm check valve to evenly apply fresh water, rinse front, rear, sides and roof of vehicle proceeding through the arch.
- .3 The design of the final rinse arch allows for immediate activation of the nozzles upon arch activation by the vehicle.
- .4 The arch uses fresh water only to provide an adequate quality of rinse and the consumption rate is 66 GPM.
- .5 The activation of the arch is done with a photo eye.
- .6 Piping will be made from SCH 80 PVC.
- .7 The control of flow of water through the arch must be achieved using a slow closing solenoid valve activated and deactivated through the use of a photo eye.

.7 Dual Chemical Injection System:

- .1 The purpose of this device is to inject detergent into the appropriate water feed lines of the wash system
- .2 A total of two (2) injection pumps are required, one (1) for the Chemical Application Arch and one (1) for the Roof Mop Module and the Four Brush Side and Rear Brush Module.
- .3 Detergent pumps (total of two required) with variable volume output ratio from 0 to 9.5 GPH.
- .4 The Detergent Injection System shall be a modular wall mounted assembly located in the wash bay.

.8 Control Systems:

- .1 Wash Control Center (WCC)
 - .1 The pre-wired motor control center shall be housed in a NEMA 4X enclosure.
 - .2 A through-the-door mainline fused disconnect shall be provided for shutdown of electrical functions.
 - .3 The control panel shall be supplied with individual starters and circuit breakers (no fuses) for all system motors.
 - .4 The control panel shall be completely pre-wired and internal wiring is terminated at numbered terminal strips.
 - .5 A programmable logic controller (PLC) will be used for all relay and timing control function. The PLC will be used as the process controller for all components and future vehicle wash systems. The PLC shall be panel mounted in the electrical enclosure, which also houses the electrical controls for the wash system.
 - .6 The programmable controller will be programmed in standard ladder logic.

- .7 A Human Machine Interface (HMI) will be provided to allow the users and maintenance personnel to adjust and change various operational modes of the wash system as well as power on and emergency switches.
- .8 Mode selection is:
 - .1 Wash – sides only.
 - .2 Wash – sides/rear.
 - .3 Detergent – off/auto.
 - .4 Touchless only.
- .9 The WCC will be equipped with an emergency stop button. The emergency stop buttons will be of the mushroom lock-out type.
- .10 The electrical control panel must be built in accordance with CSA and ULC and tested and labelled as such.
- .2 Traffic Control System:
 - .1 This device controls the entry of vehicles into the wash lane using a Red/Green Traffic Light.
 - .2 The Traffic Light will be mounted on the Roof Mop structure.
 - .3 When the wash system is in an armed state and there is no vehicle being washed the traffic light will be green advising the driver it is safe to proceed.
 - .4 If the system is not armed or a vehicle is being washed the traffic light will be red advising the driver that the wash system is not ready.
- .3 Speed Control System:
 - .1 This device monitors the speed of vehicles being driven through the wash system through the use of a Red/Green/Yellow Traffic light along with a horn.
 - .2 A green light will indicate to the driver that the vehicle is being driven at an appropriate speed.
 - .3 When a vehicle does pass through too quickly from measuring point to measuring point the system will automatically determine if it is excessive speed or just slightly over speed.
 - .1 In a case of excessive speed an immediate wash shut down is initiated the red light is turned on and the horn will sound. The wash system will require a manual restart in order to continue washing. An over speed error will be logged into the HMI.
 - .2 In the case where the vehicle is slightly over the desired speed the traffic light will turn to yellow advising the driver to slow down. If the driver does not slow down prior to the next measuring point and the vehicle remains over speed then the wash system will shut down.
 - .4 In the case of a shut down all wash functions will cease to operate, this includes brushes and soap application. Any brush that is turning will be stopped and retracted to a safe position. The only arch that will remain in function will be the final rinse arch to allow the vehicle leaving the wash lane to be rinsed off.

- .4 Rear Wash Assist System:
 - .1 This device is designed to aid the driver by notifying when the rear of the vehicle is being washed through the use of a rotating amber beacon.
 - .2 The Amber beacon must be placed in such a manner that the driver will be able to visually see it when it is in operation.
 - .3 The amber beacon will begin functioning when each of the rear brushes begins to wrap around the rear of the vehicle.
- .5 Photo Eye Kits:
 - .1 The activation photo eyes shall be designed to be activated by all fleet vehicles used by the owner. Each photo eye shall be pre-mounted and wired to a water tight junction box equipped with built-in drainage holes.
- .6 Start/Stop Remote Panel:
 - .1 This is a Nema 4X enclosure with one (1) illuminated green push button acting as the ARM/DISARM of the system and one (1) emergency stop button.
 - .2 When the green light of the illuminated push button is on the system is armed and ready to wash.
- .7 Utility Rack:
 - .1 This piece of equipment is used to consolidate all the connection points of the equipment in the wash lane to facilitate both installation and maintenance.
 - .2 Rack is made from galvanized structural steel.
 - .3 Rack can be located either on the driver or passenger side of the equipment.

2.3 RECLAIM SYSTEM

- .1 General:
 - .1 Complete structure of wash system will be made from galvanized steel.
 - .2 Reclaim System will be designed to provide 220 GPM.
 - .3 All galvanizing will be done in accordance with ASTM A123 or A385.
 - .4 The starting and stopping of the equipment will be controlled by the high level float switch.
 - .5 All electrical motors must be NEMA Premium TEFC motors.
 - .6 Reclaim pump shall be protected with a flow switch from running dry.
 - .7 Reclaim system should come with an auto prime kit.

2.4 RECLAIM SYSTEM COMPONENTS

- .1 Stainless Steel Suction Screen:
 - .1 This piece of equipment will be designed to be placed on the suction line of the reclaim system and installed submerged in the reclaim ground pit.
 - .2 The screen is made from 304 stainless steel.

- .3 Screen will have very narrow slits on it allowing primary filtration to be done in the pit.
 - .4 Suction line on the screen is 4" NPT.
 - .5 Suction screen comes equipped with a 4" PVC check valve to prevent the loss of prime of the suction line.
 - .6 Suction screen also comes equipped with a .5" NPT connection for a compressed air purge. This allows the cleaning of the screen with removing the screen from the reclaim pit.
- .2 Hydro Cyclone:
- .1 A tangential inlet and mutually tangential internal accelerating slots shall be provided to promote the proper velocity necessary for the removal of the separable solids. The internal accelerating slots shall be spiral-cut (Swirlex) for optimal flow transfer, laminar action and particle influence into the separation barrel. The separator's internal vortex shall allow this process to occur without wear to the accelerating slots.
 - .2 Separated particle matter shall spiral downward along the perimeter of the inner separation barrel, in a manner which does not promote wear of the separation barrel, and into the solids collection chamber, located below the vortex deflector stool.
 - .3 To insure maximum particle removal characteristics, Separator shall incorporate an enhanced vortex-induced pressure relief line (Vortube), drawing specific fluid from the separator's solids collection chamber via the outlet flow's vortex/venturi effect, thereby efficiently encouraging solids into the collection chamber without requiring a continuous underflow or excessive system fluid loss.
 - .4 System fluid shall exit the separator by following the center vortex in the separation barrel and spiral upward to the separator outlet.
 - .5 The separator shall feature the following access capabilities for either inspection or the removal of unusual solids/debris:
 - .1 A hand-hole port at the collection chamber.
 - .2 An upper chamber full sized grooved coupling, allowing complete access to the inlet chamber, acceleration slots, and internal separation barrel.
 - .6 The separator shall be of unishell construction with A-36, A-53B or equivalent quality carbon steel, minimum thickness of .25 inches (6.35 mm)
 - .7 Paint coating shall be acrylic urethane, spray-on, royal blue.
 - .8 Pressure gauges shall be included for the inlet/outlet of the separator.
 - .9 Pressure loss shall be between 5-18 psi (0.34-1.24 bar), remaining constant, varying only when the flow rate changes.
- .3 Aeration/Ozone Generating System:
- .1 This piece of equipment is used to produce ozone that will help eliminate the odors from the use of reclaim water.

- .2 Using building compressed air and passing the air through a filter regulator unit and over a UV-C light design to produce UV rays that are capable of transforming oxygen in the air into ozone.
 - .3 The UV light bulb will be able to produce up to 5 g/hr of ozone.
 - .4 Install on the system an indicator to indicate if the UV light is functioning.
 - .5 System should come with a mini PLC which will allow for the adjustment on the timing of use and length of time on.
- .4 Chemical Injection System:
- .1 The purpose of this device is to inject chemical into the appropriate water feed lines of the wash system.
 - .2 A total of one (1) injection pump is required. This injection pump is used to inject a rinse-aid into the final rinse arch.
 - .3 The injection pump with variable volume output ratio from 0 to 9.5 GPH.
 - .4 The Injection System will be mounted on the frame of the reclaim system.
- .5 Reclaim Control Center (RCC):
- .1 The pre-wired wash control center is housed in a NEMA 4X enclosure.
 - .2 A through-the-door mainline fused disconnect is provided for shutdown of electrical functions.
 - .3 The control panel is supplied with individual starters and circuit breakers (no fuses) for all system motors.
 - .4 The control panel shall be completely pre-wired and internal wiring is terminated at numbered terminal strips
 - .5 A mini programmable logic controller (mini PLC) is used for all relay and timing control functions. The PLC shall be panel mounted into the electrical enclosure, which also houses the electrical controls for the blower system.
 - .6 .The programmable controller is programmed in standard ladder logic.
 - .7 The RCC comes equipped with an emergency stop button. The emergency stop buttons are of the mushroom lock-out type.
 - .8 The electrical control panel must be built in accordance with CSA and ULC and tested and labelled as such.
 - .9 The electrical control panel also comes equipped with an HMI screen to allow for adjustments to the following parameters:
 - .1 The timing of when to turn on and off of the aeration feature; and
 - .2 The timing of when to turn on and off the production of Ozone.
- .6 Auto Prime Kit:
- .1 This piece of equipment is designed to re-prime the reclaim pump after a preselected period of time when the mini PLC has not received a signal that the pump is functioning normally.
 - .2 Included in this system is a .5" Water Solenoid Valve that is hooked up to the main water line. This Solenoid Valve will be activated when the

mini PLC does not receive a signal from the reclaim pump flow switch after the pre-set time.

- .3 After a secondary pre-set time the reclaim pump is still not flowing then the mini PLC will stop the pump and an alarm light will illuminate on the reclaim control panel.

2.5 BLOWER SYSTEM

.1 General:

- .1 Complete structure of wash system will be made from galvanized steel.
- .2 Blower equipment is designed to dry vehicles up to 12' high.
- .3 All galvanizing will be done in accordance with ASTM A123 or A385.
- .4 All structural aluminum used will meet ASTM B221-08.
- .5 The starting and stopping of the equipment will be controlled by photo electric eyes or any other equivalent equipment that does not require physical contact with the vehicle being washed.
- .6 All electrical motors must be NEMA Premium TEFC motors

2.6 BLOWER SYSTEM COMPONENTS

.1 Blower Arch:

- .1 This piece of equipment is designed to remove excess water from the surface of the vehicle passing through it.
- .2 The main support structure shall consist of two vertical support legs, plus an additional two (2) support legs that shall be located at the exit end of the blower system and sloped at fifty-three (53) degrees from the floor level.
- .3 All support legs shall be made from 6" x 4" x .25" rectangular galvanized tubing.
The bridge of the blower arch will also be made from 6" x 4" x .25" rectangular galvanized tubing.
- .4 There will be three (3) producers on each side installed on the diagonal leg that are fully adjustable in height and angle to suit specific vehicle configurations.
There will also be two (2) oscillating air producers suspended from the bridge oscillating left to right.
- .5 Each blower housing and nozzle will be made from roto-molded polymer, and shall be mounted on individual tubing support brackets.
- .6 The motor for each air producer shall be 15HP TEFC motor and impeller fan capable of producing 4,000 CFM.

.2 Blower Control Center (BCC):

- .1 The pre-wired wash control center is housed in a NEMA 4X enclosure.
- .2 A through-the-door mainline fused disconnect is provided for shutdown of electrical functions.
- .3 The control panel is supplied with individual starters and circuit breakers (no fuses) for all system motors.

- .4 The control panel shall be completely pre-wired and internal wiring is terminated at numbered terminal strips.
- .5 A mini programmable logic controller (mini PLC) is used for all relay and timing control functions. The PLC shall be panel mounted into the electrical enclosure, which also houses the electrical controls for the blower system.
- .6 The programmable controller is programmed in standard ladder logic.
- .7 The BCC comes equipped with an emergency stop button. The emergency stop buttons are of the mushroom lock-out type.
- .8 The electrical control panel must be built in accordance with CSA and ULC and tested and labelled as such.
- .9 All blower motors are equipped with a soft start contactor to limit electrical spikes at start-up of the equipment.

Part 3 Execution

3.1 INSTALLATION

- .1 Install equipment as per manufacturer's instructions.
- .2 Locate equipment where indicated on drawings.
- .3 Equipment supplier shall undertake the commissioning of the system and make all required adjustments to ensure proper operation.
- .4 The equipment supplier shall perform all necessary training on the operation and maintenance of the equipment.
- .5 The equipment supplier shall arrange for an adequate amount of detergent for the performance testing.
- .6 The owner's personnel shall be trained for a minimum of four (4) hours on the system operation and maintenance.
- .7 The equipment supplier shall provide the owner the names and addresses of all local service and maintenance personnel to assist in future service.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Unless otherwise noted, refer to the latest references and standards listed herein adopted by the local Authority Having Jurisdiction.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Shop Drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by:
 - .1 Detailed Drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .4 In addition to transmittal letter referred to in Section 01 33 00 – Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .5 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 10 – Closeout Submittals.
 - .2 Operation and maintenance manual reviewed by, and final copies deposited with, Consultant before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include: servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .1 Data to include schedules of tasks, frequency, tools required and task time.

- .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
- .6 Reviews:
 - .1 Submit two (2) copies of draft Operation and Maintenance Manual to Consultant for review. Submission of individual data will not be accepted unless directed by Consultant.
 - .2 Make changes as required and re-submit as directed by Consultant.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 SITE records:
 - .1 Departmental Representative will provide white prints of the mechanical drawings. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to white prints, revising white prints to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to testing mechanical equipment, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Consultant for review and make corrections as directed.
 - .4 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 – Quality Control.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:
- .2 Construction/Demolition Waste Management and Disposal: in accordance with Section 01 74 19 – Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

- .1 Not Used

Part 3 Execution

3.1 DEMOLITION

- .1 Preparation
 - .1 Coordinate utility service outages with utility company and schedule utility to locate buried services.
 - .2 Provide temporary connections to maintain existing system in service during construction. When Contractor elects to perform work on energized equipment, use personnel experienced in such operations.
 - .3 Beginning of demolition means installer accepts existing conditions.
- .2 Demolition
 - .1 Connect equipment which is existing and is to remain to the new system as required to maintain its proper operation.
 - .2 Maintain access to existing mechanical installations which remain active. Modify installation or provide access as appropriate.
- .3 Scheduling and Phasing
 - .1 Prior to the start of any demolition work within the building, provide the Consultant a schedule of phased selective demolition for all mechanical demolition at the Site.
 - .2 Provide the following information for the schedule:
 - .1 Number of phases of demolition.
 - .2 Limits of each phase.
 - .3 Dates of start/finish demolition by phase.
 - .4 Critical dates for disruptions in other mechanical systems.
 - .5 Dates and duration of temporary measures to maintain occupancy in adjacent areas.
 - .3 Coordinate the mechanical demolition schedule with all aspects of demolition under other Divisions of the specifications.

3.2 PAINTING REPAIRS AND RESTORATION

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged.

3.3 CLEANING

- .1 Clean interior and exterior of all systems.

3.4 FIELD QUALITY CONTROL

- .1 SITE Tests: conduct following tests in accordance with Section 01 45 00 – Quality Control and submit report as described in PART 1 – SUBMITTALS.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 – SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic SITE visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule Site visits, to review Work, as directed in PART 1 – QUALITY ASSURANCE.

3.5 DEMONSTRATION

- .1 Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Vehicle washing equipment.
- .3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.

3.6 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 Materials and installation for hard drawn copper domestic hot and cold water service inside a building.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).

- .1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.
- .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
- .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

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

- .1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 ASTM B88M, Standard Specification for Seamless Copper Water Tube (Metric).

.3 Canadian Standards Association (CSA International).

- .1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.

.4 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

- .1 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.5 National Research Council (NRC)/Institute for Research in Construction.

- .1 NRCC 38728, National Plumbing Code of Canada (NPC) complete with Manitoba Amendments.

1.3 SUBMITTALS

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

.2 Submit product data for following: valves.

.3 Provide maintenance data for incorporation into manual specified in Section 01 78 10 – Closeout Submittals.

Part 2 Products

2.1 CUL (Domestic Water Copper Tubing)

- .1 Tubing
 - .1 Domestic hot and cold water system, within building.
 - .2 Above ground: copper tube, hard drawn, Type L: to ASTM B88M.
- .2 Fittings
 - .1 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.
 - .2 Cast copper, solder type: to ANSI/ASME B16.18.
- .3 Joints
 - .1 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
 - .2 Solder: 95/5 tin copper alloy.
 - .3 Teflon tape: for threaded joints.
 - .4 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.
- .4 Valves
 - .1 Ball – Isolation: NPS 2 and under:
 - .1 Class 150/600WOG.
 - .2 Brass and or bronze body, full port, TFE seats, double O-ring design or PTFE packing, chrome plated solid bronze ball, lever handle, soldered ends or threaded ends.
 - .3 Acceptable material:
 - .1 Soldered: Kitz 59; Toyo 5049A
 - .2 Threaded: Kitz 58, Toyo 5044A

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with Manitoba Amendments of the NPC and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's recommendations and as specified.
- .3 Install pipe work in accordance with Section 23 05 05 – Installation of Pipework, supplemented as specified herein.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.2 VALVES

- .1 Isolate equipment, fixtures and branches with ball valves.
- .2 Remove internal parts before soldering.

3.3 BACK FLOW PREVENTORS

- .1 Install in accordance with CSA-B64 Series.
- .2 Pipe discharge to terminate over nearest drain.

3.4 STRAINERS

- .1 Install with sufficient room to remove basket.

3.5 PRESSURE TESTS

- .1 Conform to requirements of Section 22 05 00 – Common Work Results for Plumbing.
- .2 Test pressure: greater of 1.5 times maximum system operating pressure or 860 kPa.

3.6 FLUSHING AND CLEANING

- .1 Flush the addition to the system for eight (8) hours. Let stand for twenty-four (24) hours, then draw one (1) sample off longest run. Submit to testing laboratory to verify that system is clean to Provincial potable water guidelines. Let system flush for additional 2 h, then draw off another sample for testing.

3.7 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.

3.8 DISINFECTION

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.
- .2 Upon completion, provide laboratory test reports on water quality for Consultant review.

3.9 TESTING AND ADJUSTING

- .1 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After certificate of completion has been issued by authority having jurisdiction.

- .2 Backflow preventers:
 - .1 Test tightness, accessibility for O&M of cover and of valve.
 - .2 Simulate reverse flow and back-pressure conditions to test operation of backflow preventers.
 - .3 Verify visibility of discharge from open ports.
 - .4 Test in accordance with CSA-B64.
- .3 Strainers:
 - .1 Clean out repeatedly until clear.
 - .2 Verify accessibility of cleanout plug and basket.
 - .3 Verify that cleanout plug does not leak.

3.10 PERFORMANCE VERIFICATION

- .1 Timing:
 - .1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.
- .2 Procedures:
 - .1 Verify that pressure meet Design Criteria.
 - .2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 The Installation of Drainage Waste and Vent Piping – Cast Iron and Copper.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM B32, Specification for Solder Metal.
 - .2 ASTM B306, Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA B67, Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
 - .2 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .3 CAN/CSA-B125, Plumbing Fittings.
- .3 National Research Council (NRC)/Institute for Research in Construction.
 - .1 NRCC 38728, National Plumbing Code of Canada (NPC) complete with the Manitoba Amendments.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

- .1 Above ground sanitary, storm and vent Type DWV to: ASTM B306.
 - .1 Fittings:
 - .1 Cast brass: to CAN/CSA-B125.
 - .2 Wrought copper: to CAN/CSA-B125.
 - .2 Solder: lead free, tin-95:5, Type TA, to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

- .1 Buried sanitary, storm and vent minimum NPS 3, to: CAN/CSA-B70.
 - .1 Joints.
 - .1 Mechanical joints.
 - .1 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.
 - .2 Stainless steel clamps.

- .2 Hub and spigot.
 - .1 Caulking lead: to CSA B67.
 - .2 Cold caulking compounds.
- .2 Above ground sanitary, storm and vent: to CAN/CSA-B70.
 - .1 Joints.
 - .1 Hub and spigot.
 - .1 Caulking lead: to CSA B67.
 - .2 Mechanical joints.
 - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

Part 3 Execution

3.1 INSTALLATION

- .1 In accordance with Section 23 05 05 – Installation of Pipework.
- .2 Install in accordance with the National Plumbing Code and local authority having jurisdiction.
- .3 Install in accordance with manufacturer's recommendations and as specified.

3.2 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessibility and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Ensure that fixtures are properly anchored, connected to system and effectively vented.

3.4 START-UP

- .1 Provide continuous supervision during start-up.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM D2235, Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
 - .2 ASTM D2564, Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA-Series B1800, Plastic Non-pressure Pipe Compendium.
 - .2 CSAB181.1, ABS Drain, Waste, and Vent Pipe and Pipe Fittings
 - .3 CSA-B181.2, PVC Drain, Waste and Vent Pipe and Pipe Fittings.
 - .4 CSA-B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings.
- .3 National Research Council (NRC)/Institute for Research in Construction.
 - .1 NRCC 38728, National Plumbing Code of Canada (NPC) complete with the Manitoba Amendments.

Part 2 Products

2.1 PIPING AND FITTINGS

- .1 For buried and/or above ground DWV piping to:
 - .1 CSA-B181.1.
 - .2 CSA-B181.2.
 - .3 CSA-B182.1.

2.2 JOINTS

- .1 Solvent weld for PVC: to ASTM D2564.
- .2 Solvent weld for ABS: to ASTM D2235.

Part 3 Execution

3.1 INSTALLATION

- .1 In accordance with Section 23 05 05 – Installation of Pipework.
- .2 Install in accordance with National Plumbing Code and local authority having jurisdiction.
- .3 Install in accordance with manufacturer's recommendations and as specified.

3.2 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.

3.3 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessibility and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Ensure fixtures are properly anchored, connected to system and effectively vented.

3.4 START-UP

- .1 Provide continuous supervision during start-up.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for piping, fittings, equipment used in compressed air systems.
- .2 Related Sections:
 - .1 Section 01 33 00 – Submittal Procedures.
 - .2 Section 01 45 00 – Quality Control.
 - .3 Section 01 74 19 – Construction/Demolition Waste Management and Disposal.
 - .4 Section 01 78 00 – Closeout Submittals.
 - .5 Section 22 05 00 – Common Work Results for Plumbing.
 - .6 Section 23 05 17 – Pipe Welding.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME Boiler and Pressure Vessel Code Section VIII Pressure Vessels.
 - .1 BPVC-VIII B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 1.
 - .2 BPVC-VIII-2 B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 2 - Alternative Rules.
 - .3 BPVC-VIII-3 B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 3 - Alternative Rules High Press Vessels.
 - .2 ASME B16.5, Pipe Flanges and Flanged Fittings.
 - .3 ASME B16.11, Forged Fittings, Socket-Welding and Threaded.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A181/A181M, Standard Specification for Carbon Steel Forgings for General Purpose Piping.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

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

- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
 - .2 Submit WHMIS MSDS in accordance with Section 02 61 33 – Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.
- .3 Shop Drawings:
 - .1 Submit shop drawings to indicate project layout including layout, dimensions and extent of piping system.
 - .1 Vertical and horizontal piping locations and elevations and connections details.
 - .2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
 - .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .4 Instructions: submit manufacturer's installation instructions.
 - .5 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 – Quality Control.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and disposal: Section 01 74 19 – Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 PIPING

- .1 Piping: to ASTM A53/A53M, schedule 80 seamless black steel.
- .2 Fittings:
 - .1 NPS2 and smaller: to ASME B16.11, schedule 80 steel, socket welded.
 - .2 NPS2 1/2 and larger: to ASME B16.11, schedule 80 steel, butt or socket welded.
- .3 Couplings: to ASME B16.11, socket welded or threaded half coupling type.
- .4 Unions: 1,000 kPa malleable iron with brass-to-iron ground seat.

- .5 Dissimilar metal junctions: use dielectric unions.
- .6 Flanges:
 - .1 NPS2 and smaller: to ASME B16.5, forged steel, raised face and socket welded.
 - .2 NPS2 1/2 and larger: to ASME B16.5, forged steel, raised face and slip-on or weld neck.
- .7 Joints:
 - .1 NPS2 and smaller: socket welded.
 - .2 NPS2 1/2 and larger: butt welded.

2.2 PIPING

- .1 Piping: Aircom Purestream aluminium extrusion alloy EN AW T6 UNI-EN 755-2 with inside and outside titanium-based, chrome-free and RoHS-complying treating and electrocoated outside surface, rated for 174 PSIG operating pressure.
- .2 Fittings: Aircom Purestream enameled die-cast aluminium alloy compression fitting rated for 174 PSIG operating pressure. Provide adaptors for steel pipes as required.

2.3 BALL VALVES

- .1 Three piece design or top entry for ease of in-line maintenance.
 - .1 To ASTM A181/A181M, Class 70, carbon steel body socket welded or screwed ends, carbon steel ball and associated trim suitable for compressed air application.
 - .2 To withstand 1034 kPa maximum pressure.

2.4 COUPLERS/CONNECTORS

- .1 Industrial interchange series, full-bore.
- .2 Maximum inlet pressure: 1700 kPa.
- .3 Valve seat: moulded nylon.
- .4 Body: zinc plated steel.
- .5 Threads: NPT.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions and datasheet.

3.2 COMPRESSED AIR PIPING CONNECTIONS AND INSTALLATION

- .1 Install shut-off valves at outlets, major branch lines and in locations as indicated.
- .2 Install unions to permit removal or replacement of equipment.
- .3 Install compressed air trap and pressure equalizing pipe at moisture collecting points. Drain pipe to nearest floor drain.
- .4 Make branch connections from top of main.
- .5 Install compressed air trap at bottom of risers and at low points in mains, piped to nearest drain. Distance between drain points to be 30 m maximum.
- .6 Weld steel piping in accordance with Section 23 05 17 – Pipe Welding and;
 - .1 To ASME code and requirements of authority having jurisdiction.
 - .2 Weld concealed and inaccessible piping regardless of size.

3.3 FIELD QUALITY CONTROL

- .1 SITE Tests/Inspection:
 - .1 Testing: pressure test in accordance with requirements of Section 22 05 00 – Common Work Results for Plumbing, for four (4) hours minimum, to 1,100 kPa, with outlets closed and with compressor isolated from system. Pressure drop not to exceed 10 kPa.
- .2 Manufacturer's Field Services:
 - .1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of work with Contract.
 - .2 Provide manufacturer's field services, consisting of product use recommendations and periodic Site visits for inspection of product installation, in accordance with manufacturer's instructions.
 - .3 Schedule Site visits to review work at stages listed:
 - .1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
 - .2 Twice during progress of work at twenty-five (25) percent and sixty (60) percent complete.
 - .3 Upon completion of Work, after cleaning is carried out.
- .3 Obtain reports within three (3) days of review and submit immediately to Consultant.

3.4 CLEANING

- .1 Refer to Section 23 08 01 – Performance Verification of Mechanical Piping Systems and Section 23 08 02 – Cleaning and Start-Up of Mechanical Piping System.

- .2 Cleaning: blow out piping to clean interior thoroughly of oil and foreign matter.
- .3 Check entire installation is approved by authority having jurisdiction.
- .4 Perform cleaning operations in accordance with manufacturer's recommendations.
- .5 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM).
 - .1 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - .2 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA).
 - .1 AWWA C700, Cold Water Meters-Displacement Type, Bronze Main Case.
 - .2 AWWA C701, Cold Water Meters-Turbine Type for Customer Service.
 - .3 AWWA C702-1, Cold Water Meters-Compound Type.
- .3 Canadian Standards Association (CSA International).
 - .1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.
 - .2 CSA-B79, Floor, Area and Shower Drains, and Cleanouts for Residential Construction.
 - .3 CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Plumbing and Drainage Institute (PDI).
 - .1 PDI-G101, Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
 - .2 PDI-WH201, Water Hammer Arresters Standard.
- .5 National Research Council (NRC)/Institute for Research in Construction.
 - .1 NRCC 38728, National Plumbing Code of Canada (NPC) complete with Manitoba Amendments.
- .1 NSF International
 - .1 NSF/ANSI Standard 61 – Drinking Water System Components – Health Effects

1.2 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
 - .2 Indicate dimensions, construction details and materials for specified items.
 - .3 Submit product data sheets to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details and accessories.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- .4 Instructions: submit manufacturer's installation instructions.
- .5 Manufacturers' Field Reports: manufacturers' field reports specified.
- .6 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 10 – Closeout Submittals, include:
 - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

Part 2 Products

2.1 BACK FLOW PREVENTERS

- .1 Back Flow Preventers: to CSA-B64 Series, application reduced pressure double check valve assembly.
- .2 Operation: Continuous pressure applications unless otherwise indicated.
- .3 Pressure loss: 86kPa maximum, through middle third flow range.
- .4 Body: Epoxy coated cast iron for NPS 2-1/2 (DN 65) and larger.
- .5 End connections: Flanged for NPS 2-1/2 (DN 65) and larger.
- .6 Configuration: Designed for horizontal straight through flow.
- .7 Accessories:
- .8 Valves 2-1/2 (DN 65) and larger
- .9 Non-rising stem resilient seated guide gate valves with flanged ends on inlet and outlet.
- .10 Acceptable: Watts Series LF909

2.2 WATER HAMMER ARRESTORS

- .1 Stainless steel or Copper construction, bellows or piston type: to PDI-WH201.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.

3.2 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada and authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

3.3 WATER HAMMER ARRESTORS

- .1 Install on branch supplies to fixtures or where indicated.

3.4 BACK FLOW PREVENTORS

- .1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.

3.5 START-UP

- .1 Timing: start-up only after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Certificate of static completion has been issued.
- .2 Provide continuous supervision during start-up.

3.6 TESTING AND ADJUSTING

- .1 Water hammer arrestors:
 - .1 Verify proper installation of correct type of water hammer arrester.
- .2 Backflow preventers:
 - .1 Test tightness, accessibility for O&M of cover and of valve.
 - .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers and backflow preventers.
 - .3 Verify visibility of discharge from open ports.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment or components.

3.3 DRAINS

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge where indicated separately to above floor drain. Discharge to be visible.
- .4 Drain valves: NPS 3/4 ball valve, with hose end male thread, cap and chain.

3.4 DIELECTRIC COUPLINGS

- .1 General: Compatible with system, to suit pressure rating of system.
- .2 Locations: Where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: Isolating flanges.

3.5 PIPEWORK INSTALLATION

- .1 Screwed fittings.
- .2 Protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Slope piping, except where indicated, in direction of flow for positive condensate drainage.
- .6 Ream pipes, remove scale and other foreign material before assembly.
- .7 Use eccentric reducers at pipe size changes to ensure positive drainage.
- .8 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless otherwise indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Use ball valves at branch take-offs for isolating purposes except where otherwise specified.
- .9 Check Valves:
 - .1 Install check valves as indicated.

3.6 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by City.
- .2 Request written approval ten (10) days minimum, prior to commencement of Work.
- .3 Be responsible for damage to existing plant by this Work.
- .4 Ensure daily clean-up of existing areas.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.9, Building Service Piping.
 - .2 ANSI/ASME Boiler and Pressure Vessel Code:
 - .1 Section V: Non-destructive Examination.
 - .2 Section IX: Welding and Brazing Qualifications.
- .2 American Welding Society (AWS)
 - .1 AWS C1.1, Recommended Practices for Resistance Welding.
 - .2 AWS Z49.1, Safety Welding, Cutting and Allied Process.
 - .3 AWS W1, Welding Inspection Handbook.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.
 - .2 CSA W48 series, Filler Metals and Allied Materials for Metal Arc Welding.
 - .3 CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.
 - .4 CSA-W117.2, Safety in Welding, Cutting and Allied Processes.
 - .5 CSA W178.1, Certification of Welding Inspection Organizations.
 - .6 CSA W178.2, Certification of Welding Inspectors.

1.2 QUALIFICATIONS

- .1 Welders
 - .1 Welding qualifications in accordance with CSA B51.
 - .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
 - .3 Furnish welder's qualifications to Consultant.
 - .4 Each welder to possess identification symbol issued by authority having jurisdiction.
 - .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.
- .2 Inspectors
 - .1 Inspectors qualified to CSA W178.2.

1.3 QUALITY ASSURANCE

- .1 Registration of welding procedures in accordance with CSA B51.
- .2 Copy of welding procedures available for inspection.
- .3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

Part 2 Products

2.1 ELECTRODES

- .1 Electrodes: in accordance with CSA W48 Series.

Part 3 Execution

3.1 WORKMANSHIP

- .1 Welding: in accordance with ANSI/ASME B31.9, using procedures conforming to AWS B3.0, AWS C1.1, and applicable requirements of provincial authority having jurisdiction.

3.2 INSTALLATION REQUIREMENTS

- .1 Identify each weld with welder's identification symbol.
- .2 Backing rings:
 - .1 Where used, fit to minimize gaps between ring and pipe bore.
 - .2 Do not install at orifice flanges.
- .3 Fittings:
 - .1 NPS 2 and smaller: install welding type sockets.
 - .2 Branch connections: install welding tees or forged branch outlet fittings.

3.3 INSPECTION AND TESTS - GENERAL REQUIREMENTS

- .1 Review weld quality requirements and defect limits of applicable codes and standards with Consultant before work is started.
- .2 Formulate "Inspection and Test Plan" in co-operation with Consultant.
- .3 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.4 SPECIALIST EXAMINATIONS AND TESTS

- .1 General
 - .1 Perform examinations and tests by specialist qualified in accordance with CSA W178.1 and CSA W178.2 and reviewed by Consultant.
 - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
 - .3 Inspect and test ten (10) percent of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination.

- .2 Hydrostatically test welds to requirements of ANSI/ASME B31.9 and as specified herein.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .4 Failure of visual examinations:
 - .1 Upon failure of welds by visual examination, perform additional testing as directed by Consultant of total of up to ten (10) percent of welds, selected at random by Consultant by particle tests.

3.5 DEFECTS CAUSING REJECTION

- .1 As described in ANSI/ASME B31.9 and ANSI/ASME Boiler and Pressure Vessels Code.
- .2 In addition, compressed air systems:
 - .1 Undercutting greater than 0.8 mm adjacent to cover bead on outside of pipe.
 - .2 Undercutting greater than 0.8 mm adjacent to root bead on inside of pipe.
 - .3 Undercutting greater than 0.8 mm at combination of internal surface and external surface.
 - .4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in 1,500 mm length of weld depth of such defects being greater than 0.8 mm.
 - .5 Repair cracks and defects in excess of 0.8 mm in depth.
 - .6 Repair defects whose depth cannot be determined accurately on basis of visual examination or particle tests.

3.6 REPAIR OF WELDS WHICH FAILED TESTS

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

3.7 WELDING VENTILATION

- .1 Contractor to provide temporary welding extraction system vented outdoors away from operable windows, doors or ventilation air intake openings.
- .2 Space in which the welding is taken place is to be maintained at a negative pressure in relation to the remaining facility.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.9, Building Service Piping.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A125, Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563, Specification for Carbon and Alloy Steel Nuts.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP58, Pipe Hangers and Supports – Materials, Design and Manufacture.
 - .2 ANSI/MSS SP69, Pipe Hangers and Supports – Selection and Application.
 - .3 MSS SP89, Pipe Hangers and Supports – Fabrication and Installation Practices.
- .5 Underwriter's Laboratories of Canada (ULC)

1.2 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.9 or MSS SP58.
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
 - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

1.3 SUBMITTALS

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

- .2 Submit shop drawings and product data for following items:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .3 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 10 – Closeout Submittals.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 – Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.9 and MSS SP58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

- .1 Finishes:
 - .1 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers to MSS-SP58 and MSS-SP69.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut.
- .4 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies: fabricated from material complying with ASTM A-36.
- .5 Hanger rods: threaded rod material to MSS SP58:
 - .1 Ensure that hanger rods are subject to tensile loading only.

- .2 Provide linkages where lateral or axial movement of pipework is anticipated.
- .6 Pipe attachments: material to MSS SP58:
 - .1 Attachments for steel piping: carbon steel black.
 - .2 Oversize pipe hangers and supports.
- .7 Adjustable clevis: material to MSS SP69, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

2.3 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel.

2.4 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 GENERAL

- .1 Hanger components shall not be used for purposes other than for which they were designed. They shall not be used for rigging and erection purposes.

3.3 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
 - .1 Install on piping systems at compressors, and as indicated.

3.4 HANGER SPACING

Maximum Pipe Size: NPS	Maximum Spacing Steel
up to 1-1/4	2.1 m
1-1/2	2.7 m
2	3.0 m
2-1/2	3.3 m
3	3.6 m
4	4.2 m

3.5 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.
- .4 For pipe attachment to steel joints support piping from upper joist chord only.

3.6 HORIZONTAL MOVEMENT

- .1 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.7 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
 - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 Thermal insulation for piping and piping accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

- .1 The National Energy Code of Canada for Buildings – 2011.
- .2 ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.

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

- .1 ASTM B209M, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.
- .2 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .3 ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C533, Calcium Silicate Block and Pipe Thermal Insulation.
- .6 ASTM C547, Mineral Fiber Pipe Insulation.
- .7 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .8 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

- .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .2 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts

.4 Manufacturer's Trade Associations

- .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).

.5 Underwriters' Laboratories of Canada (ULC)

- .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

- .3 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings
- .4 CAN/ULC-S702.2, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

- .1 For purposes of this section:
 - .1 "CONCEALED" – insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" – will mean "not concealed" as specified.
- .2 TIAC:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: specialist in performing work of this Section, and have at least three (3) years successful experience in this size and type of project, qualified to standards of TIAC.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 – Product Requirement.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.
 - .4 Place excess or unused insulation and insulation accessory materials in designated containers.
 - .5 Divert unused metal materials from landfill to metal recycling facility.
 - .6 Dispose of unused adhesive material at official hazardous material collections site.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees Celsius mean temperature when tested in accordance with ASTM C335.
- .3 Hot Piping: Formed fine fibrous glass or mineral fibre pipe insulation, with factory applied general purpose jacket, factory moulded to conform to piping, "K" value maximum 0.035 W/m degrees Celsius. Service temperature up to 150°C
- .4 Cold Piping: Foamed plastic of closed cell structure or closed cell elastomer, "K" value maximum 0.04 W/m degrees Celsius. The water vapour transmission rate not to exceed 0.1 perms.

2.3 INSULATION SECUREMENT

- .1 Tape: self-adhesive, aluminum, plain, 50 mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 Hydraulic setting or air drying on mineral wool, to ASTM C449/C449M.

2.5 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 JACKETS

- .1 Aluminum:
 - .1 To ASTM B209.

- .2 Thickness: 0.50 mm sheet.
 - .3 Finish: smooth or stucco embossed.
 - .4 Joining: longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5mm thick at 300 mm spacing.
- .2 Canvas:
- .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: compatible with insulation.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PRE-INSTALLATION REQUIREMENT

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada and authority having jurisdiction.
- .2 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- .3 Ensure insulation is continuous through inside walls. Pack around pipes with fire proof self-supporting insulation material, properly sealed.
- .4 Insulate piping, fittings and valves. Do not insulate unions, flanges (except on flanged valves), strainers, flexible connections and expansion joints. Terminate insulation neatly with plastic material trowelled on a bevel.
- .5 Finish insulation neatly on hangers, supports and other protrusions.
- .6 Locate insulation or cover seams in least visible locations. Locate seams on piping in ceiling spaces on the underside of the pipe.
- .7 Provide recovering jackets on exposed insulation throughout, including equipment rooms. Make smooth uneven insulated surfaces before recovering.

- .8 Cold Piping: Seal lap joints with one hundred (100) percent coverage of vapour barrier adhesive. Seal butt joints with 50 mm² in wide strips of vapour barrier sealed with vapour barrier adhesive. For fittings and valves, apply hydraulic insulating cement; or apply factory fabricated insulation half shells, seal all laps and joints.
- .9 Flare out staples may be used to secure jacket laps on hot systems. Staples are to be applied on 100 mm⁴ in centres.
- .10 Hot Piping: For fittings and valves, apply hydraulic insulating cement; or apply factory fabricated insulation half shells.

3.4 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry. Overlaps to manufacturer's instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

3.5 PIPING INSULATION SCHEDULES

- .1 Provide pipe insulation in accordance to the more stringent requirements of the National Energy Code of Canada for Buildings or the values indicated in the table below.

	Piping or Equipment	Pipe Sizes NPS	Insulation Thickness (mm)	Recovery Jacket
1	Domestic Cold Water	All sizes	25	Canvas
2	Domestic Hot Water	13 mm to 51 mm	25.4	Canvas
3	Domestic Hot Water	64 mm to 127 mm	38.1	Canvas

END OF SECTION

Part 1 General

1.1 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

- .1 In accordance with Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.

1.2 POTABLE WATER SYSTEMS

- .1 When cleaning is completed and system filled:
 - .1 Verify performance of equipment and systems as specified elsewhere in Division 23.
 - .2 Check for proper operation of water hammer arrestors. Run one outlet for ten (10) seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or recharge air chambers. Repeat for each outlet and flush valve.
 - .3 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.

1.3 SANITARY AND STORM DRAINAGE SYSTEMS

- .1 Buried systems: perform tests prior to back-filling. Perform hydraulic tests to verify grades and freedom from obstructions.
- .2 Ensure that fixtures are properly anchored, connected to system.
- .3 Operate each fixture to verify drainage and no leakage.

1.4 VEHICLE WASHING EQUIPMENT

- .1 Equipment supplier shall undertake the commissioning of the system and make all required adjustments to ensure proper operation.
- .2 The equipment supplier shall arrange for an adequate amount of detergent for the performance testing.

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 SUMMARY

- .1 Section Includes:
 - .1 Procedures and cleaning solutions for cleaning mechanical piping systems.

1.2 REFERENCES

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

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 – Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Quality assurance submittals: submit following in accordance with Section 01 33 00 – Submittal Procedures.
 - .1 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00 – Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 19 – Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 CLEANING SOLUTIONS

- .1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.
- .2 Sodium carbonate: 0.40 kg per 100 L water in system.

- .3 Low-foaming detergent: 0.01 kg per 100 L water in system.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 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 SUMMARY

.1 Section Includes:

- .1 General requirements that are common to NMS sections found in Section 26 – Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
- .2 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

- .1 EEMAC 2Y-1, Light Gray Colour for Indoor Switch Gear.

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

- .1 Material Safety Data Sheets (MSDS).

.4 City of Winnipeg Water and Waste Department – Electrical Design Guide, Rev 01

.5 City of Winnipeg Water and Waste Department – Automation Design Guide, Rev 00

.6 City of Winnipeg Water and Waste Department – Identification Standard, Rev 00

1.3 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

- .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates for control items in English.

1.4 SUBMITTALS

.1 Quality Control:

- .1 Provide CSA certified equipment and material.
- .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to Site.

- .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of Contract.
 - .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Contract Administrator.
- .2 Manufacturer's Field Reports: submit to Contract Administrator manufacturer's written report, within three (3) days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in Part 3 - Field Quality Control.

1.5 QUALITY ASSURANCE

- .1 Quality Assurance:
- .2 Qualifications: Electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
- .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

1.6 SYSTEM STARTUP

- .1 Instruct City's personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Assist City's personnel and the Contract Administrator in the start-up of equipment.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant will aspects of its care and operation.

1.7 Site

- .1 Classification of Bus Wash Areas:
- .1 Building Superstructure: Ordinary; and
 - .2 Transit Bus Wash area: Category 1.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

- .1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to Site and submit such approval as described in Part 1 - Submittals.

- .2 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: in accordance with Division 29.

2.3 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of inspection authorities.
- .2 Lamacoid signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
 - .1 Nameplates: lamacoid 3 mm thick plastic engraving sheet, white with black core, lettering accurately aligned and engraved into core mechanically attached with self-tapping stainless steel screws.
 - .2 Lamacoids as follows:

Application	Text Size	Text
Electrical Equipment - General	5 mm	Line 1: Identifier
Circuit Breaker - Separate	5 mm	Line 1: Identifier Line 2: Load Identifier Line 3: Load Description
Disconnect Switch - Separate	5 mm	Line 1: Identifier Line 2: Load Identifier Line 3: Load Description
Fire Alarm Devices	8 mm	Line 1: Identifier
Light Switches	3 mm	Source Panel and Circuit Number
Motor Control Centre	8 mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By
Motor Starter or MCC Bucket	5 mm	Line 1: Load Identifier Line 2: Load Description
Panelboards	8mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By
Receptacles	3 mm	Source Panel and Circuit Number

Application	Text Size	Text
Switchgear	8 mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By
Switchgear Breaker	8 mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By
Transformer - Indoor	8 mm	Line 1: Identifier Line 2: Rating, System Voltage Line 3: Fed By
Transformer – Outdoor	10 mm	Line 1: Identifier Line 2: Rating, System Voltage Line 3: Fed By

- .2 Wording on nameplates to be approved Contract Administrator prior to manufacture.

2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes, and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.
- .4 Colour Codes

	Prime	Auxiliary
Power, 120/208/240 VAC	Black	
UPS Power, 120/208/240 VAC	Black	Green
Control Wiring, 120VAC	Black	Orange
Fire Alarm	Red	
Low Voltage Communication/General	Blue	
Low Voltage Control Wiring, <50 V	Blue	Orange
Intrinsically Safe	Blue	White
up to 250 V	Yellow	
up to 600 V	Yellow	Green

	Prime	Auxiliary
Other Communication Systems	Green	Blue

.5 Cable Colour Codes

	Prime	Auxiliary
Power, 120/208/240 VAC	Black	
UPS Power, 120/208/240 VAC	Black	Green
Control Wiring, 120VAC	Black	Orange
Fire Alarm	Red	
Low Voltage Communication/General	Blue	
Low Voltage Control Wiring, <50 V	Blue	Orange
Intrinsically Safe	Blue	White
up to 600 V	Yellow	Green
Other Communication Systems	Green	Blue

2.8 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two (2) coats of finish enamel.

- .1 Paint outdoor electrical equipment "equipment green" finish.
- .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1400 mm.
 - .2 Wall receptacles:

- .1 General: 300 mm.
- .2 In mechanical rooms: 1400 mm.
- .3 Panelboards: as required by Code or as indicated.
- .4 Control panels: as indicated.

3.4 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays, and fuses are installed to required values and settings.

3.5 FIELD QUALITY CONTROL

- .1 Conduct following tests:
 - .1 Circuits originating from branch distribution panels.
 - .2 Lighting and its control.
 - .3 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1,000 V instrument.
 - .3 Check resistance to ground before energizing.
- .2 Carry out tests in presence of Contract Administrator.
- .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of Project.

3.6 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for wire and box connectors.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2 No.65, Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors.
 - .2 Clamp for stranded copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors:

- .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
- .2 Install fixture type connectors and tighten. Replace insulating cap.
- .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

- .1 CSA C22.2 No.0.3, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No.131, Type TECK 90 Cable.

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with thermoplastic insulation type TWU or TWH rated at 600 V.

2.2 TECK CABLE

- .1 Cable: to CAN/CSA-C22.2 No.131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 1,000 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum.
- .6 Overall covering: thermoplastic polyvinyl chloride material.
- .7 Fastenings:
 - .1 One-hole galvanized straps to secure surface cables 50 mm and smaller. Two-hole galvanized straps for cables larger than 50 mm.
 - .2 Category 1 Stainless Steel construction for one-hole and two-hole straps.
 - .3 Channel type supports for two (2) or more cables at 900 mm centers.
 - .4 Galvanized steel threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors

2.3 CONTROL CABLES

- .1 Type LVT: soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.
- .2 600 V type: stranded annealed copper conductors, sizes as indicated with PVC insulation type TW, or cross-linked polyethylene type RW90 (x-link with shielding of metallized tapes over each pair of conductors and overall covering of thermoplastic jacket interlocked armour and jacket over sheath of PVC).

Part 3 Execution

3.1 INSTALLATION OF TECK CABLE 0 -1000 V

- .1 Install cables.
 - .1 Group cables wherever possible on channels.
- .2 Lay cable in cabletroughs/cable tray in accordance with Section 26 05 36.
- .3 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors - 0–1,000 V.

3.2 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit.
- .2 Group armoured control cables wherever possible on channels.
- .3 Ground control cable shield at one (1) end only.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results – Electrical.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association, (CSA International)

Part 2 Products

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Rod electrodes: copper clad steel 19 mm dia. by 3 m long.
- .3 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .4 Insulated grounding conductors: green, type RW90.
- .5 Ground bus: copper, size as required, complete with insulated supports, fastenings, connectors.
- .6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings;
 - .2 Protective type clamps;
 - .3 Bolted type conductor connectors;
 - .4 Thermit welded type conductor connectors;
 - .5 Bonding jumpers, straps; and
 - .6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .10 Ground secondary service pedestals.

3.2 ELECTRODES

- .1 Install rod electrodes and make grounding connections.
- .2 Bond separate, multiple electrodes together.
- .3 Use size 2/0AWG copper conductors for connections to electrodes.

3.3 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of primary 600 V system, secondary 208 V system.

3.4 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.5 GROUNDING BUS

- .1 Install copper grounding bus mounted on insulated supports on wall.
- .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections sized in accordance with the Canadian Electrical Code.

3.6 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to Site conditions and to approval of Contract Administrator.
- .3 Perform tests before energizing electrical system.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Not Used

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 Category 1 - U shape aluminum, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.
- .2 Normal conditions – U shape galvanized steel, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

Part 3 Execution

3.1 INSTALLATION

- .1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 Category 1 – One-hole stainless steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Category 1 – Two-hole stainless steel straps for conduits and cables larger than 50 mm.
 - .3 Dry areas One-hole galvanized steel straps to secure surface conduits and cables 50 mm and smaller.
 - .4 Dry areas Two-hole galvanized steel straps for conduits and cables larger than 50 mm.
 - .5 Beam clamps to secure conduit to exposed steel work.
- .6 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia. threaded rods and spring clips.

- .2 Support two (2) or more cables or conduits on channels supported by 6 mm dia. threaded rod hangers where direct fastening to building construction is impractical.
- .7 For surface mounting of two (2) or more conduits use channels at 1 m on center spacing.
- .8 Provide metal brackets, frames, hangers, clamps, and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit Shop Drawings and product data for cabinets in accordance with Section 01 33 00 – Submittal Procedures.

Part 2 Products

2.1 JUNCTION AND PULL BOXES

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.
- .3 Category 1 – Ferrous construction with watertight conduit or cable connectors
- .4 Category 1 – Ferrous covers gasketed and watertight.

2.2 CABINETS

- .1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- .2 Type T: sheet steel cabinet, with hinged door, latch, lock, two (2) keys, containing sheet steel backboard for surface mounting.

Part 3 Execution

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install terminal block as indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.2 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA C22.1, Canadian Electrical Code, Part 1.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one (1) system are grouped.

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one (1) conduit enters one (1) side with extension and plaster rings as required.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.6 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of Work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
 - .2 CSA C22.2 No. 45, Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2 Rigid PVC (Un-plasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3, Flexible Non-metallic Tubing.

Part 2 Products

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, aluminum threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

- .1 One-hole aluminum or stainless steel straps to secure surface conduits 50 mm and smaller. Two-hole aluminum or stainless steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two (2) or more conduits at 1 m on center (OC).
- .4 Stainless steel threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 X-ray cast walls and floors before coring to confirm location of embedded items.
- .3 Existing structure may contain asbestos. Confirm materials are free of asbestos before drilling or coring.
- .4 Use rigid aluminum threaded conduit in all areas.
- .5 Use epoxy coated conduit underground and in cast concrete.
- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment.
- .7 Minimum conduit size for lighting and power circuits: 19 mm.
- .8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .9 Mechanically bend steel conduit over 19 mm dia.
- .10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .11 Install fish cord in empty conduits.
- .12 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .13 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

- .1 Paint walls before installation of electrical equipment including conduits.
- .2 Run parallel or perpendicular to building lines.

- .3 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .4 Run conduits in flanged portion of structural steel.
- .5 Group conduits wherever possible on suspended or surface channels.
- .6 Do not pass conduits through structural members except as indicated.
- .7 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel. Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.
- .5 Do not place conduits in slabs in which slab thickness is less than four (4) times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

3.6 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (PVC **excepted**) with heavy coat of bituminous paint.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.47, Air-Cooled Transformers (Dry Type).
 - .2 CSA C9, Dry-Type Transformers.
- .2 National Electrical Manufacturers Association (NEMA)

1.4 PRODUCT DATA

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

Part 2 Products

2.1 TRANSFORMERS

- .1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA-C22.2No.47.
- .2 Design.
 - .1 Type: ANN.
 - .2 Windings: Copper
 - .3 Rating as specified.
 - .4 Voltage taps: standard.
 - .5 Insulation: 180 degrees C temperature rise.
 - .6 Basic Impulse Level (BIL): standard.
 - .7 Hipot: standard.
 - .8 Average sound level: standard.
 - .9 Impedance at 17°C: standard.
 - .10 Enclosure: CSA 1, removable metal front panel c/w sprinkler shield.

- .11 Finish: in accordance with Section 26 05 01 – Common Work Results – Electrical.
- .12 Acceptable manufactures: Schneider Electric, Eaton, Rex Manufacturing.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Nameplate wording example:
 - T-2
 - 15kVA
 - 600V – 120/208V

Part 3 Execution

3.1 INSTALLATION

- .1 Mount dry type transformers on floor or in MCC section.
- .2 Ensure adequate clearance around transformer for ventilation.
- .3 Install transformers in level upright position.
- .4 Remove shipping supports only after transformer is installed and just before putting into service.
- .5 Loosen isolation pad bolts until no compression is visible.
- .6 Make primary and secondary connections in accordance with wiring diagram.
- .7 Energize transformers after installation is complete.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 26 05 00 – Common Work Results – Electrical.
- .3 Section 26 28 21 – Moulded Case Circuit Breakers.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.29, Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

Part 2 Products

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29 and product of one (1) manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 600 V panelboards: bus and breakers rated for 18 kA (symmetrical) interrupting capacity or as indicated.
- .3 250 V panelboards: bus and breakers rated for 10 kA (symmetrical) interrupting capacity or as indicated.
- .4 Panelboard width to be less than 230 mm.
- .5 Integral TVSS.
- .6 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

- .7 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated on plans.
- .8 Two (2) keys for each panelboard and key panelboards alike.
- .9 Copper bus with neutral of same ampere rating as mains.
- .10 Mains: suitable for bolt-on breakers.
- .11 Trim with concealed front bolts and hinges.
- .12 Trim and door finish: baked grey enamel.
- .13 Approved manufacture: Schneider Electric, Eaton

2.2 BREAKERS

- .1 Breakers: to Section 26 28 21 – Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Lock-on devices for fire alarm clock outlet, emergency, door supervisory, intercom, stairway, exit and night light circuits.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 Execution

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on U-channel. Where practical, group panelboards on common supports.
- .3 Mount panelboards to height specified in Section 26 05 00 – Common Work Results - Electrical.
- .4 Mount panelboards in MCC.

- .5 Connect loads to circuits.
- .6 Connect neutral conductors to common neutral bus with respective neutral identified.
- .7 Measure load current on each phase and adjust phase loading for a balanced system.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 26 05 00 – Common Work Results - Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA-C22.2 No.55, Special Use Switches.
 - .4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

Part 2 Products

2.1 SWITCHES

- .1 20 A, 120 V, single pole, double pole, three-way, four-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire;
 - .2 Silver alloy contacts;
 - .3 Urea or melamine moulding for parts subject to carbon tracking;
 - .4 Suitable for back and side wiring; and
 - .5 Ivory toggle.
- .3 Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to eighty (80) percent of rated capacity of motor loads.
- .4 Switches of one (1) manufacturer throughout project.
- .5 Acceptable materials: Leviton specification grade, Hubbell specification grade.

2.2 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:
 - .1 Ivory urea moulded housing
 - .2 Suitable for No. 10 AWG for back and side wiring
 - .3 Break-off links for use as split receptacles
 - .4 Eight (8) back wired entrances, four side wiring screws
 - .5 Triple wipe contacts and riveted grounding contacts
- .2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
 - .1 Ivory urea moulded housing
 - .2 Suitable for No. 10 AWG for back and side wiring
 - .3 Four (4) back wired entrances, two-side wiring screws
- .3 Other receptacles with ampacity and voltage as indicated.
- .4 Receptacles of one manufacturer throughout project.
- .5 Acceptable materials: Leviton specification grade, Hubbell specification grade.

2.3 COVER PLATES

- .1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.
- .2 Cover plates from one manufacturer throughout project.
- .3 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.
- .4 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

Part 3 Execution

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one (1) switch is required in one (1) location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

- .2 Mount receptacles at height in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .3 Cover plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials for moulded-case circuit breakers.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Include time-current characteristic curves for breakers with ampacity of 90 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers: to CSA C22.2 No. 5.
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees Celsius ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from three (3) to eight (8) times current rating.
- .5 Circuit breakers to have minimum symmetrical RMS interrupting capacity rating matching panel board or switchboard containing breaker.

2.2 THERMAL MAGNETIC BREAKERS [DESIGN A]

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 MAGNETIC BREAKERS [DESIGN B]

- .1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 SOLID STATE TRIP BREAKERS [DESIGN D]

- .1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous tripping for phase and ground fault short circuit protection.

Part 3 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.
- .2 Set adjustable trip settings according to coordination study.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for fused and non-fused disconnect switches.

1.2 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results – For Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.
 - .2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

1.4 SUBMITTALS

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

Part 2 Products

2.1 DISCONNECT SWITCHES

- .1 Heavy duty non-fusible, horsepower rated disconnect switch to CAN/CSA C22.2 No.4.
- .2 Provision for padlocking in OFF position.
- .3 Quick-make, quick-break action.
- .4 ON-OFF switch position indication on switch enclosure cover.
- .5 Category 1 locations: NEMA 4.
- .6 Category 2 locations: NEMA 4x.
- .7 Ordinary locations: NEMA 12.
- .8 Outdoor: NEMA 3.
- .9 Acceptable Manufacturer: Square D, Eaton, Hubbell, Pass & Seymour, Leviton.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results – For Electrical.

Part 3 Execution

3.1 INSTALLATION

- .1 Install disconnect switches as indicated and as required by CSA C22.1.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for industrial control devices including pushbutton stations, control and relay panels.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.14, Industrial Control Equipment.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA ICS 1, Industrial Control and Systems: General Requirements.

1.4 SHOP DRAWINGS

- .1 Submit Shop Drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Include schematic, wiring, interconnection diagrams.

1.5 QUALITY ASSURANCE

- .1 Submit to Contract Administrator copy of test results.

Part 2 Products

2.1 AC CONTROL RELAYS

- .1 Control Relays: to CSA C22.2 No.14.
- .2 Fixed contact plug-in type: general purpose heavy duty with two (2) poles. Coil rating: 120 V. Contact rating: 240V, 2 A.

2.2 RELAY ACCESSORIES

- .1 Standard contact cartridges: normally-open – convertible to normally-closed in field.

2.3 OILTIGHT LIMIT SWITCHES

- .1 Snap action type: roller, rod, fork, lever, top, side, push, wobble stick actuator, CSA type 4 enclosure. Contact rating 240VAC, 2A

2.4 SOLID STATE TIMING RELAYS

- .1 Construction: AC operated electronic timing relay with solid-state timing circuit to operate output contact.
- .2 Operation: on-delay or off-delay.
- .3 Potentiometer: self contained to provide time interval adjustment.
- .4 Supply voltage: 120 V, AC, 60 Hz.
- .5 Temperature range: minus 20 to 60°Celsius.
- .6 Output contact rating: maximum voltage 300 V AC or DC. Current: 2A
- .7 Timing ranges: field adjustable, minimum 0.1s, maximum sixty (60) hours.

2.5 OPERATOR CONTROL STATIONS

- .1 Enclosure: CSA Type 4, surface mounting:

2.6 PUSHBUTTONS

- .1 Illuminated, Heavy duty Oil tight. Operator extend type, as indicated. Black, with 2-NO and 2-NC contacts rated at 10 A, AC, labels as indicated. Stop pushbuttons coloured red. Start pushbuttons coloured green

2.7 EMERGENCY STOP PUSHBUTTONS

- .1 Illuminated, Heavy duty oil tight. Mushroom head, 2-position, Push-Pull operator, Red, with 2-NO and 2-NC contacts rated at 10 A, AC/DC, labels as indicated.

2.8 SELECTOR SWITCHES

- .1 Maintained 3 position labelled as indicated heavy duty oil tight, operators wing lever contact arrangement as indicated, rated 120 V, 10A, AC.

2.9 INDICATING LIGHTS

- .1 Heavy duty Oil tight, full voltage, LED type, push-to-test and lens colour as indicated. Supply voltage: 120 V, lamp voltage: 120 V, labels as indicated.

2.10 CONTROL AND RELAY PANELS

- .1 CSA Type 12 sheet steel enclosure with hinged pad-lockable access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

2.11 CONTROL CIRCUIT TRANSFORMERS

- .1 Single phase, dry type.
- .2 Primary: 600 V, 60 Hz ac.

- .3 Secondary: 120 V, AC.
- .4 Rating: 150 VA, or larger as required.
- .5 Secondary fuse: ampacity as required.
- .6 Close voltage regulation as required by magnet coils and solenoid valves.

2.12 THERMOSTAT LINE VOLTAGE

- .1 Wall mounted, for exhaust fan control.
- .2 Full load rating: 8A at 120 V.
- .3 Temperature setting range: 0 to 30 degrees Celsius.
- .4 Thermometer Range: 0 to 30 degrees Celsius.
- .5 Markings in 5 degree increments.
- .6 Differential temperature fixed at 1 degree Celsius.

Part 3 Execution

3.1 INSTALLATION

- .1 Install pushbutton stations, control and relay panels, control devices and interconnect.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one (1) section at time and check out operation of section.
- .3 Upon completion of sectional test, undertake group testing.
- .4 Check out complete system for operational sequencing.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results – Electrical.

1.2 REFERENCES

- .1 NEMA contactors and motor starters

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Indicate:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout of identified internal and front panel components.
 - .4 Enclosure types.
 - .5 Wiring diagram for each type of starter.
 - .6 Interconnection diagrams.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for motor starters for incorporation into manual.
- .2 Include operation and maintenance data for each type and style of starter.

1.5 EXTRA MATERIALS

- .1 Provide maintenance materials.
- .2 Provide listed spare parts for each different size and type of starter:
 - .1 Three (3) contacts, stationary.
 - .2 Three (3) contacts, movable.
 - .3 One (1) contacts, auxiliary.
 - .4 One (1) control transformer[s].
 - .5 One (1) operating coil.
 - .6 Two (2) fuses.
 - .7 Ten (10) percent indicating lamp bulbs used.

Part 2 Products

2.1 MATERIALS

- .1 Starters: NEMA standards, IEC rated equipment not allowed.

2.2 MANUAL MOTOR STARTERS

- .1 Single phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
 - .1 Switching mechanism, quick make and break.
 - .2 One overload heater, manual reset, trip indicating handle.
- .2 Accessories:
 - .1 Toggle switch, heavy duty oil tight labelled as indicated.
 - .2 Indicating light: heavy duty oil tight, LED type and colour as indicated.
 - .3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

- .1 Provide control signal interface to new RTU Control panel.
- .2 Combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
 - .1 Contactor solenoid operated, rapid action type.
 - .2 Motor overload protective device in each phase, manually reset from outside enclosure.
 - .3 Wiring and schematic diagram inside starter enclosure in visible location.
 - .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
 - .5 Hand-Off-Auto selector switch mounted on starter door.
 - .6 Red running light.
 - .7 Green stopped light.
 - .8 Amber alarm light.
- .3 Combination type starters to include motor circuit interrupter with operating lever on outside of enclosure to control disconnect motor circuit interrupter and provision for:
 - .1 Locking in "OFF" position with up to three (3) padlocks.
 - .2 Independent locking of enclosure door.
 - .3 Provision for preventing switching to "ON" position while enclosure door open.
 - .4 Shut trip or under voltage trip protection not allowed.
- .4 Accessories:
 - .1 Pushbuttons and selector switches: heavy duty, oil tight labelled as indicated.
 - .2 Indicating lights: heavy duty, oil tight, LED type and color as indicated.
 - .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.4 CONTROL TRANSFORMER

- .1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus twenty (20) percent spare capacity.

2.5 FINISHES

- .1 Apply finishes to enclosure in accordance with Section 26 05 00 – Common Work Results – Electrical.

2.6 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Manual starter designation label, black plate, white letters, size 1, engraved as indicated.
- .3 Magnetic starter designation label, black plate, white letters, size 4 engraved as indicated.

Part 3 Execution

3.1 INSTALLATION

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct fuses and overload devices elements installed.
- .3 Confirm operation of motor starters from level controller and RTU Control System.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results – Electrical and manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION