



SPECIFICATIONS

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Project: PO #45360751 – RNUP
Northern Welcome Area
6944 19th Avenue

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Specifications

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Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises general construction of Northern Welcome Area, located at Rouge National Urban Park, Markham, Ontario.

1.2 CONTRACT METHOD

- .1 Construct Work under single stipulated combined price contract.

1.3 CONTRACTOR USE OF PREMISES

- .1 Limit use of premises for Work, for storage, and for access, to allow:
 - .1 Owner occupancy.
 - .2 Partial owner occupancy.
 - .3 Work by other contractors.
 - .4 Public usage.
- .2 Co-ordinate use of premises under direction of Departmental Representative or Designate.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative or Designate.
- .6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.4 EXISTING SERVICES

- .1 Notify, Departmental Representative or Designate and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative or Designate 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by Departmental Representative or Designate with minimum disturbance.
- .3 Provide alternative routes for personnel and vehicular traffic.

- .4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative or Designate of findings.
- .5 Submit schedule to and obtain approval from Departmental Representative or Designate for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services to maintain critical building and tenant systems.
- .7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .8 Where unknown services are encountered, immediately advise Departmental Representative or Designate and confirm findings in writing.
- .9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .10 Record locations of maintained, re-routed and abandoned service lines.
- .11 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.5 DOCUMENTS REQUIRED

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

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 ACCESS AND EGRESS

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

1.2 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Contractor is responsible to arrange sanitary facilities for use by Contractor's personnel.
- .5 Closures: protect work temporarily until permanent enclosures are completed.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

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

1.4 EXISTING SERVICES

- .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
- .3 Provide for personnel access and vehicular traffic.
- .4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.5 SPECIAL REQUIREMENTS

- .1 Carry out noise generating Work Monday to Friday outside 7:00 to 16:30 hours hours and on Saturdays, Sundays and statutory holidays.

- .2 Submit schedule in accordance with Section 01 32 18 - Construction Progress Schedules - Bar (GANTT) Chart.
- .3 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .4 Keep within limits of work and avenues of ingress and egress.
- .5 Ingress and egress of Contractor vehicles at site is limited to Departmental Representative.
- .6 Deliver materials outside of peak traffic hours 17:00 to 07:00 and 13:00 to 15:00 unless otherwise approved by Departmental Representative.

1.6 SECURITY CLEARANCES

- .1 Personnel employed on this project will be subject to security check. Obtain clearance, as instructed, for each individual who will require to enter premises.
- .2 Personnel will be checked daily at start of work shift and provided with pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.

1.7 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions. Smoking is not allowed.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 CASH ALLOWANCES

- .1 Amount of each allowance, for Work specified in respective specification Sections is as follows:
 - .1 Section 03 30 00 – inspection and testing of Cast in place concrete; \$4500.00.
 - .2 Section 04 05 12 – inspection and testing of mortar and grout; \$3000.00.
 - .3 Section 04 05 19 – inspection and testing of masonry anchorage and reinforcing; \$3000.00

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 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- .1 Particular requirements for inspection and testing to be carried out by qualified testing laboratory are specified under various sections.

1.2 APPOINTMENT AND PAYMENT

- .1 Departmental Representative or Designate will appoint and pay for services of testing laboratory except following:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for Contractor's convenience.
 - .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
 - .4 Mill tests and certificates of compliance.
 - .5 Tests specified to be carried out by Contractor under the supervision of Departmental Representative or Designate.
 - .6 Additional tests specified as follows:
- .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative or Designate to verify acceptability of corrected work.

1.3 CONTRACTOR'S RESPONSIBILITIES

- .1 Provide labour, equipment and facilities to:
 - .1 Provide access to Work for inspection and testing.
 - .2 Facilitate inspections and tests.
 - .3 Make good Work disturbed by inspection and test.
 - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2 Notify Departmental Representative or Designate sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative or Designate.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting four days in advance of meeting date to Departmental Representative or Designate.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants and, affected parties not in attendance.
- .8 Representative of Contractor, the Consultant, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Departmental Representative or Designate, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: in accordance with Section [01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.
 - .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section [01 52 00 - Construction Facilities.
 - .5 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

- .6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .7 Owner provided products.
- .8 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .11 Monthly progress claims, administrative procedures, photographs, hold backs.
- .12 Appointment of inspection and testing agencies or firms.
- .13 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

- .1 During course of Work and 2 weeks prior to project completion, schedule progress meetings in a bi-weekly basis and/or as directed by the Departmental Representative or Designate.
- .2 Contractor, major Subcontractors involved in Work, Consultants and Departmental Representative or Designate are to be in attendance.
- .3 Notify parties minimum four (4) days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.
- .5 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
 - .7 Revision to construction schedule.
 - .8 Progress schedule, during succeeding work period.
 - .9 Review submittal schedules: expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review proposed changes for affect on construction schedule and on completion date.
 - .12 Other business.

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 PRECEDENCE

- .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.2 DEFINITIONS

- .1 Activity: An element of Work performed during course of Project. An activity normally has an expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart). A graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: Original approved plan (for Project, workpackage, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: Number of work periods (not including holidays or other nonworking periods) required to complete an activity or other Project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: A summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: A significant event in Project, usually completion of major deliverable.
- .8 Project Schedule: The planned dates for performing activities and the planned dates for meeting milestones. A dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: Overall system operated by [Engineer] [Consultant] to enable monitoring of project work in relation to established milestones.

1.3 REQUIREMENTS

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

- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.4 SUBMITTALS

- .1 Submit to Departmental Representative or Designate within 15 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .2 Submit Project Schedule to Departmental Representative or Designate within 5 working days of receipt of acceptance of Master Plan.

1.5 PROJECT MILESTONES

- .1 Project milestones form interim targets for Project Schedule.
 - .1 Excavation completed within TBD working days of Award of Contract date.
 - .2 Substructure completed within TBD working days of Award of Contract date.
 - .3 Superstructure completed within TBD working days of Award of Contract date.
 - .4 Building closed-in and weatherproofed within TBD working days of Award of Contract date.
 - .5 Interior finishing and fitting, mechanical, and electrical work completed within TBD working days of Award of Contract date.
 - .6 Interim Certificate (Substantial Completion) within TBD working days of Award of Contract date.

1.6 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative or Designate will review and return revised schedules within 5 working days.
- .3 Revise impractical schedule and resubmit within 5 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.7 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.

- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Excavation.
 - .6 Backfill.
 - .7 Building footings.
 - .8 Slab on grade.
 - .9 Structural Steel.
 - .10 Siding and Roofing.
 - .11 Interior Architecture (Walls, Floors and Ceiling).
 - .12 Plumbing.
 - .13 Lighting.
 - .14 Electrical.
 - .15 Piping.
 - .16 Heating, Ventilating, and Air Conditioning.
 - .17 Millwork.
 - .18 Fire Systems.
 - .19 Testing and Commissioning.
 - .20 Supplied equipment long delivery items.
 - .21 Departmental Representative or Designate supplied equipment required dates.

1.8 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.9 PROJECT MEETINGS

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Submit to Departmental Representative or Designate submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative or Designate. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative or Designate, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's or Designate's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative or Designate review.
- .10 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which

adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

- .4 Allow 15 days for Departmental Representative's or Designate's review of each submission.
- .5 Adjustments made on shop drawings by Departmental Representative or Designate are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative or Designate prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative or Designate may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative or Designate in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, in high definition PDF format, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 Submissions include:
 - .1 Submit detailed plan for environmental protection, drainage, and dirt haul plan for review by Departmental Representative or Designate.
 - .2 Submit detailed erosion and sedimentation plan for review Departmental Representative or Designate.
 - .3 Date and revision dates.
 - .4 Project title and number.
 - .5 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .6 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .7 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.

- .7 Operating weight.
- .8 Wiring diagrams.
- .9 Single line and schematic diagrams.
- .10 Relationship to adjacent work.
- .9 After Departmental Representative's or Designate's review, distribute copies.
- .10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative or Designate may reasonably request.
- .11 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative or Designate where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative or Designate.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative or Designate.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative or Designate.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .15 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative or Designate.
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .16 Submit electronic copies of Operation and Maintenance Data and manuals for requirements requested in specification Sections and as requested by Departmental Representative or Designate.
- .17 Delete information not applicable to project.
- .18 Supplement standard information to provide details applicable to project.

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

1.3 SAMPLES

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's or Designate's business address.
- .3 Notify Departmental Representative or Designate in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative or Designate are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative or Designate may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 CERTIFICATES AND TRANSCRIPTS

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

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 PRECEDENCE

- .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.2 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .3 Province of Ontario
 - .1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. .

1.3 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
- .3 Submit copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative and authority having jurisdiction weekly.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00.
- .7 Departmental Representative or Designate will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 10 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative or Designate within 10 days after receipt of comments from Departmental Representative or Designate.

- .8 Departmental Representative's or Designate's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative or Designate.
- .10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.4 FILING OF NOTICE

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

1.5 SAFETY ASSESSMENT

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

1.6 MEETINGS

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

1.7 PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
 - .1 TBD.

1.8 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Departmental Representative or Designate may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.9 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.10 COMPLIANCE REQUIREMENTS

- .1 Comply with Ontario Health and Safety Act and Regulations for Construction Projects, R.S.O..

1.11 UNFORSEEN HAZARDS

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

1.12 POSTING OF DOCUMENTS

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

1.13 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative or Designate.
- .2 Provide Departmental Representative or Designate with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative or Designate may stop Work if non-compliance of health and safety regulations is not corrected.

1.14 POWDER ACTUATED DEVICES

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

1.15 WORK STOPPAGE

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

Part 2 Products

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 PRECEDENCE

- .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.2 FIRES

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

1.3 DISPOSAL OF WASTES

- .1 Do not bury rubbish and waste materials on site unless approved by Departmental Representative or Designate.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.4 DRAINAGE

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.5 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated or designated by Engineer.

1.6 WORK ADJACENT TO WATERWAYS

- .1 Do not operate construction equipment in waterways.

- .2 Do not use waterway beds for borrow material.
- .3 Do not dump excavated fill, waste material or debris in waterways.
- .4 Design and construct temporary crossings to minimize erosion to waterways.
- .5 Do not skid logs or construction materials across waterways.
- .6 Avoid indicated spawning beds when constructing temporary crossings of waterways.
- .7 Do not blast under water or within 100 m of indicated spawning beds.

1.7 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authorities emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

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 AND CODES

- .1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions and municipal by-laws.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 INSPECTION

- .1 Allow Departmental Representative or Designate access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative or Designate instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections, or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative or Designate will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction.

1.2 INDEPENDENT INSPECTION AGENCIES

- .1 Departmental Representative will engage, as required, independent inspection/ testing agencies for purpose of quality assurance only, that is, verify and validate Contractor's quality control process for construction materials, workmanship, environmental protection, waste disposal, etc. Contractor is responsible for quality control. Employment of inspection/ testing agencies does not relax responsibility to perform work in accordance with Contract Documents.
- .2 Cost of such services will be borne by Departmental Representative or Designate.
- .3 Allocated costs: to Section 01 21 00 - Allowances.
- .4 Provide equipment required for executing inspection and testing by appointed agencies.
- .5 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .6 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative or Designate at no cost to Parks Canada Agency. Pay costs for retesting and re-inspection.

1.3 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.4 PROCEDURES

- .1 Notify appropriate inspection/ testing agency through Departmental Representative or Designate in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.5 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative or Designate resulting from inspection/ testing and 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 Departmental Representative or Designate it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Parks Canada Agency will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by.

1.6 REPORTS

- .1 Submit 2 copies of inspection and test reports to Departmental Representative or Designate.
- .2 Provide copies to subcontractor of work being inspected or tested.

1.7 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as requested.
- .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative or Designate and may be authorized as recoverable.

1.8 MOCK-UPS

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Construct in locations acceptable to Departmental Representative or Designate.
- .3 Prepare mock-ups for Departmental Representative or Designate review with reasonable promptness and in orderly sequence, to not cause delays in Work.

- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 If requested, Departmental Representative or Designate will assist in preparing schedule fixing dates for preparation.
- .6 Remove mock-up at conclusion of Work or when acceptable to Departmental Representative or Designate.
- .7 Mock-ups may remain as part of Work.
- .8 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.9 MILL TESTS

- .1 Submit mill test certificates as requested.

1.10 EQUIPMENT AND SYSTEMS

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.2 DEWATERING

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

1.3 WATER SUPPLY

- .1 Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.
- .2 Pay for utility charges at prevailing rates.

1.4 TEMPORARY HEATING AND VENTILATION

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of Work.
 - .2 Protect Work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.
- .5 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.
- .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Permanent heating system of building, to be used when available. Be responsible for damage to heating system if use is permitted.
- .7 On completion of Work for which permanent heating system is used, replace filters.
- .8 Ensure Date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Departmental Representative.
- .9 Pay costs for maintaining temporary heat, when using permanent heating system.
- .10 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .11 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.5 TEMPORARY POWER AND LIGHT

- .1 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.
- .2 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Departmental Representative.
- .3 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.
- .4 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.6 FIRE PROTECTION

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

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

1.2 SCAFFOLDING

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain scaffolding, ramps, ladders, temporary stairs and similar temporary works.

1.3 HOISTING

- .1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2 Hoists to be operated by qualified operator.

1.4 SITE STORAGE/LOADING

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.5 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not disrupt performance of Work and park operation.
- .2 Provide and maintain adequate access to project site.
- .3 Clean runways and taxi areas where used by Contractor's equipment.
- .4 After the award of contract the Contractor must prepare (for review and approval by Parks Canada) a project plan which will include the provision of continued operations of

the existing office at this location including staff parking. See L1 for existing parking area dimensions to be maintained.

1.6 SECURITY

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

1.7 OFFICES

- .1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors to provide their own offices as necessary. Direct location of these offices to be approved by Departmental Representative or Designate.

1.8 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.9 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.10 CONSTRUCTION SIGNAGE

- .1 No other signs or advertisements, other than warning signs, are permitted on site.
- .2 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.
- .3 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative or Designate.

1.11 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Provide access and temporary relocated roads as necessary to maintain traffic. Submit city permits required for culvert installation and for any works related to road ways.

- .2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative or Designate.
- .3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs
- .4 Protect travelling public from damage to person and property.
- .5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
- .7 Construct access and haul roads necessary.
- .8 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.
- .9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .10 Dust control: adequate to ensure safe operation at all times.
- .11 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative or Designate.
- .12 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.
- .13 Provide snow removal during period of Work.
- .14 Remove, upon completion of work, haul roads designated by Departmental Representative or Designate.

1.12 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction and Section 01 57 13.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.2 HOARDING

- .1 Erect temporary site enclosures using "Modu-Loc" green fence panels, 1/8 m high, installed as per manufacturers instructions or approved alternate.
- .2 Provide one lockable truck entrance gate and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.
- .3 Maintain public side of enclosure in clean condition.
- .4 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.3 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs, and similar hazards.
- .2 Provide as required by governing authorities.

1.4 WEATHER ENCLOSURES

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

1.5 ACCESS TO SITE

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

1.6 PUBLIC TRAFFIC FLOW

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

1.7 FIRE ROUTES

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

1.8 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.9 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Be responsible for damage incurred due to lack of or improper protection.

1.10 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 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 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .2 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative or Designate reserves right to have such products or systems tested to prove or disprove conformance.
- .3 Cost for such testing will be born by Departmental Representative or Designate in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 STORAGE, HANDLING AND PROTECTION

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

- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber and other moisture sensitive materials on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative or Designate.
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's or Designate's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.4 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Owner will be paid for by Parks Canada Agency. Unload, handle and store such products.

1.5 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative or Designate in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative or Designate will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative or Designate to require removal and re-installation at no increase in Contract Price or Contract Time.

1.6 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

Departmental Representative or Designate if required Work is such as to make it impractical to produce required results.

- .2 Do not employ anyone unskilled in their required duties. Departmental Representative or Designate reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative or Designate, whose decision is final.

1.7 CO-ORDINATION

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.8 CONCEALMENT

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

1.9 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.10 LOCATION OF FIXTURES

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

1.11 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.

1.12 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.13 PROTECTION OF WORK IN PROGRESS

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

1.14 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and pedestrian and vehicular traffic.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

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 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practice in Province of Ontario, acceptable to Departmental Representative or Designate.

1.2 SURVEY REFERENCE POINTS

- .1 Existing base horizontal and vertical control points are designated on drawings.
- .2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to and approval of Departmental Representative or Designate.
- .4 Report to Departmental Representative or Designate when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

1.3 SURVEY REQUIREMENTS

- .1 Establish lines and levels, locate and lay out, by instrumentation.
- .2 Stake for grading, fill and landscaping features.
- .3 Stake slopes and berms.
- .4 Establish pipe invert elevations.
- .5 Stake batter boards for foundations.
- .6 Establish foundation column locations and floor elevations.
- .7 Establish lines and levels for mechanical and electrical work.

1.4 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative or Designate of findings.
- .2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as per the Contract Documents and/ or directed by Departmental Representative or Designate.

1.5 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.6 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.
- .3 Record locations of maintained, re-routed and abandoned service lines.

1.7 SUBMITTALS

- .1 Submit name and address of Surveyor to Departmental Representative or Designate.
- .2 On request of Departmental Representative or Designate, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

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 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Parks Canada Agency (PCA) or separate contractor.
- .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Parks Canada Agency (PCA) or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.2 MATERIALS

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

1.3 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.4 EXECUTION

- .1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .12 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative or Designate. Do not burn waste materials on site, unless approved by Departmental Representative or Designate.
- .3 Clear snow and ice from access to building, bank/pile snow in designated areas only.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .7 Dispose of waste materials and debris off site.
- .8 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 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 Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative or Designate. Do not burn waste materials on site, unless approved by Departmental Representative or Designate.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fittings, walls, and floors.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .12 Inspect finishes, fittings and equipment and ensure specified workmanship and operation.
- .13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .14 Remove dirt and other disfiguration from exterior surfaces.
- .15 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .16 Sweep and wash clean paved areas.
- .17 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .18 Clean roofs, downspouts, and drainage systems.
- .19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .20 Remove snow and ice from access to building.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss Parks Canada Agency’s (PCA’s) Waste Management Plan and Goals.
- .2 PCA Waste Management Goal 75 percent of total Project Waste to be diverted from landfill sites. Provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.
- .3 Accomplish maximum control of solid construction waste.
- .4 Preserve environment and prevent pollution and environment damage.
- .5 Comply with “Guideline for Use, Handling and Disposal of Treated Wood”.

1.2 DEFINITIONS

- .1 **Class III:** non-hazardous waste - construction renovation and demolition waste.
- .2 **Inert Fill:** inert waste - exclusively asphalt and concrete.
- .3 **Materials Source Separation Program (MSSP):** consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .4 **Recyclable:** ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .5 **Recycle:** process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .6 **Recycling:** process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .7 **Reuse:** repeated use of product in same form but not necessarily for same purpose.
Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .8 **Salvage:** removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

- .9 **Separate Condition:** refers to waste sorted into individual types.
- .10 **Source Separation:** acts of keeping different types of waste materials separate beginning from first time they became waste.
- .11 **Waste Audit (WA):** detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.
- .12 **Waste Management Co-ordinator (WMC) :** contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .13 **Waste Reduction Workplan (WRW):** written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (Schedule A).

1.3 DOCUMENTS

- .1 Maintain at job site, one copy of following documents:
 - .1 Waste Audit.
 - .2 Waste Reduction Workplan.
 - .3 Material Source Separation Plan.
 - .4 Schedules A, B completed for project.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following prior to [project start-up]:
 - .1 Submit 2 copies of completed Waste Audit (WA): Schedule A.
 - .2 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule B.
 - .3 Submit 2 copies of Materials Source Separation Program (MSSP) description.
- .3 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form.
 - .1 Failure to submit could result in hold back of subsequent progress claim and/ or final payment.
 - .2 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled, co-mingled and separated off-site or disposed of.
 - .3 For each material reused, sold or recycled from project, include amount in tonnes quantities by number, type and size of items, and the destination.
 - .4 For each material land filled or incinerated from project, include amount in tonnes of material and identity of landfill, incinerator or transfer station.

1.5 WASTE AUDIT (WA)

- .1 Conduct WA prior to project start-up.
- .2 Prepare WA: Schedule A.
- .3 Record, on WA - Schedule A, extent to which materials or products used consist of recycled or reused materials or products.

1.6 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare WRW prior to project start-up.
- .2 WRW should include but not limited to:
 - .1 Destination of materials listed.
 - .2 Deconstruction/disassembly techniques and sequencing.
 - .3 Schedule for deconstruction/disassembly.
 - .4 Location.
 - .5 Security.
 - .6 Protection.
 - .7 Clear labelling of storage areas.
 - .8 Details on materials handling and removal procedures.
 - .9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.
- .3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .4 Describe management of waste.
- .5 Identify opportunities for reduction, reuse, and recycling of materials. Based on information acquired from WA.
- .6 Post WRW or summary where workers at site are able to review content.
- .7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.
- .8 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.

1.7 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

- .1 Prepare MSSP and have ready for use prior to project start-up.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative or Designate.

- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide containers to deposit reusable and recyclable materials.
- .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .6 Locate separated material[s] in area[s] which minimize material damage.
- .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
 - .1 Transport to approved and authorized recycling facility.
- .8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.
 - .1 Ship materials to site operating under Certificate of Approval.
 - .2 Materials must be immediately separated into required categories for reuse or recycling.

1.8 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative or Designate.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect surface drainage, mechanical and electrical from damage and blockage.
- .4 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off-site processing facility for separation.
 - .3 Provide waybills for separated materials.

1.9 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste volatile materials into waterways, storm, or sanitary sewers.
- .3 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total tonnage generated.
 - .4 Tonnage reused or recycled.

- .5 Reused or recycled waste destination.
- .4 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.
- 1.10 USE OF SITE AND FACILITIES**
 - .1 Execute work with least possible interference or disturbance to normal use of premises.
 - .2 Maintain security measures established by existing facility.
- 1.11 SCHEDULING**
 - .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.
- Part 2 Products**
- 2.1 NOT USED**
 - .1 Not Used.
- Part 3 Execution**
- 3.1 APPLICATION**
 - .1 Do Work in compliance with WRW.
 - .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
- 3.2 CLEANING**
 - .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
 - .2 Clean-up work area as work progresses.
 - .3 Source separate materials to be reused/recycled into specified sort areas.
- 3.3 DIVERSION OF MATERIALS**
 - .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.
 - .1 Mark containers or stockpile areas.
 - .2 Provide instruction on disposal practices.

.2 On-site sale of recyclable material[s] is not permitted.

.3 Construction Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Cardboard	100	<input type="text"/>
Plastic Packaging	100	<input type="text"/>
Rubble	100	<input type="text"/>
Steel	100	<input type="text"/>
Wood (uncontaminated)	100	<input type="text"/>
Other		<input type="text"/>

3.4 WASTE AUDIT (WA)

.1 Schedule A - Waste Audit (WA):

(1) Material Category	(2) Material Quantity Unit	(3) Estimated Waste %	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused
-----------------------	----------------------------	-----------------------	------------------------------------	----------------------	----------------	--------------

Wood and
 Plastics
 Material
 Description
 Off-cuts
 Warped
 Pallet Forms
 Plastic
 Packaging
 Cardboard
 Packaging
 Other

Doors and
 Windows
 Material
 Description
 Painted
 Frames
 Glass
 Wood
 Metal
 Other

3.5 WASTE REDUCTION WORKPLAN (WRW)

.1 Schedule B:

(1) Material Category	(2) Person(s) Respon- sible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s)) Destina- tion
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Wood and
 Plastics
 Material
 Descriptio
 n
 Chutes
 Warped
 Pallet
 Forms
 Plastic
 Packag
 ing
 Card-
 board
 Packag
 ing
 Other

Doors and
 Windows
 Material
 Descriptio
 n
 Painted
 Frames
 Glass
 Wood
 Metal
 Other

3.6 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Schedule E - Government Chief Responsibility for the Environment:

Province	Address	General Inquires	Fax
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Province	Address	General Inquires	Fax
Ontario	Ministry of Environment and Energy, 135 St. Clair Avenue West Toronto ON M4V 1P5 Environment Canada Toronto ON	416-323-4321 800- 565-4923 416-734-4494	416-323-4682

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative or Designate and Consultant in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
 - .2 Request Departmental Representative or Designate and Consultant inspection.
 - .2 Departmental Representative or Designate and Consultant Inspection:
 - .1 Departmental Representative or Designate and Consultant and Contractor to inspect Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Equipment and systems: tested, adjusted and balanced and fully operational.
 - .4 Operation of systems: demonstrated to Parks Canada Agency's personnel.
 - .5 Work: complete and ready for final inspection.
 - .4 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by Departmental Representative or Designate and Consultant.
 - .2 When Work incomplete according to Departmental Representative or Designate and Consultant, complete outstanding items and request re-inspection.

1.2 FINAL CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with contractor's representative and Departmental Representative or Designate and Consultant, in accordance with Section 01 31 19 - Project Meetings to:
 - .1 Verify Project requirements.
 - .2 Departmental Representative or Designate and Consultant to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative or Designate and Consultant, four final copies of operating and maintenance manuals in English.
- .3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4 Provide evidence, if requested, for type, source and quality of products supplied.

1.3 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
 - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

- .5 Arrange content by systems under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in acceptable electronic format on CD.

1.4 CONTENTS - PROJECT RECORD DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

1.5 AS -BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, at site for Departmental Representative or Designate one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.

- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative or Designate.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.

1.7 FINAL SURVEY

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

1.8 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
 - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
 - .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control.

- .15 Additional requirements: as specified in individual specification sections.

1.9 MATERIALS AND FINISHES

- .1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional requirements: as specified in individual specifications sections.

1.10 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock Materials:
 - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.

1.11 DELIVERY, STORAGE AND HANDLING

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Departmental Representative.

1.12 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative or Designate approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative or Designate receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty 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 , executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties until time specified for submittal.
- .7 Except for items put into use with Parks Canada Agency's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 12 month warranty inspection, measured from time of acceptance, by Departmental Representative or Designate.
- .9 Include information contained in warranty management plan as follows:

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

1.13 WARRANTY TAGS

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative or Designate.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.

- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Demonstrate operation and maintenance of equipment and systems to Parks Canada Agency's personnel two weeks prior to date of interim completion.
- .2 Parks Canada Agency: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- .3 Preparation:
 - .1 Verify conditions for demonstration and instructions comply with requirements.
 - .2 Verify designated personnel are present.
 - .3 Ensure equipment has been inspected and put into operation.
 - .4 Ensure testing, adjusting, and balancing has been performed and equipment and systems are fully operational.
- .4 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 needed during instructions.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's or Designate approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration, with list of persons present.
- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.3 QUALITY ASSURANCE

- .1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
 - .1 Instruct Parks Canada Agency's personnel.
 - .2 Provide written report that demonstration and instructions have been completed.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Approved: 2005-09-30

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.
- .2 Acronyms:
 - .1 BMM - Building Management Manual.
 - .2 Cx - Commissioning.
 - .3 EMCS - Energy Monitoring and Control Systems.
 - .4 O M - Operation and Maintenance.
 - .5 PI - Product Information.
 - .6 PV - Performance Verification.
 - .7 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with Contract Documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the BMM.
 - .3 Effectively train O M staff.
- .2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

- .1 For Cx responsibilities refer to Section 01 91 31 - Commissioning (Cx) Plan.
- .2 Cx to be a line item of Contractor's cost breakdown.

- .3 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .4 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built [facility] is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.
- .5 Departmental Representative will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Consultant and Departmental Representative or Designee.
 - .2 Equipment, components and systems have been commissioned.
 - .3 O M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Consultant and Departmental Representative or Designee, to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review Contract Documents, confirm by writing to Consultant and Departmental Representative or Designee.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to Consultant and Departmental Representative or Designee.
 - .7 Have Cx schedules up-to-date.

- .8 Ensure systems have been cleaned thoroughly.
- .9 Complete TAB procedures on systems, submit TAB reports to Consultant and Departmental Representative or Designee for review and approval.
- .10 Ensure "As-Built" system schematics are available.
- .4 Inform Consultant and Departmental Representative or Designee in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to Consultant or Departmental Representative or Designee before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit no later than 4 weeks after award of Contract:
 - .1 Name of Contractor's Cx agent.
 - .2 Draft Cx documentation.
 - .3 Preliminary Cx schedule.
 - .2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
 - .3 Submit proposed Cx procedures to Consultant and Departmental Representative or Designee where not specified and obtain written approval at least 8 weeks prior to start of Cx.
 - .4 Provide additional documentation relating to Cx process required by Departmental Representative or Designee.

1.8 COMMISSIONING DOCUMENTATION

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms for requirements and instructions for use.
- .2 Departmental Representative or Designee to review and approve Cx documentation.
- .3 Provide completed and approved Cx documentation to Departmental Representative or Designee.

1.9 COMMISSIONING SCHEDULE

- .1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 18 - Construction Progress Schedules - Bar (GANTT) Chart].
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Approval of Cx reports.
 - .2 Verification of reported results.

- .3 Repairs, retesting, re-commissioning, re-verification.
- .4 Training.

1.10 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings: Section 01 32 18 - Construction Progress Schedules - Bar (GANTT) Chart and as specified herein.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage. Section 01 32 18 - Construction Progress Schedules - Bar (GANTT) Chart. Departmental Representative or Designee to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
 - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Departmental Representative or Designee, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.12 WITNESSING OF STARTING AND TESTING

- .1 Provide 14 days notice prior to commencement.
- .2 Departmental Representative or Designee to witness of start-up and testing.
- .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

- .1 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for approval by Departmental Representative.
 - .3 Arrange for Departmental Representative to witness tests.
 - .4 Obtain written approval of test results and documentation from Departmental Representative before delivery to site.

- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .3 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.
- .4 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
 - .2 Visual inspection of quality of installation.
 - .2 Start-up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System PV: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
- .4 Document require tests on approved PV forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
 - .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
 - .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
 - .1 Rejected equipment to be remove from site and replace with new.

- .2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,
 - .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit Departmental Representative for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF COMMISSIONING

- .1 Notify Departmental Representative at least 21 days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 INSTRUMENTS / EQUIPMENT

- .1 Submit to Departmental Representative for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.
- .2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.

- .3 Equipment as required to complete work.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 Under actual operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 EMCS trending to be available as supporting documentation for performance verification.

1.21 WITNESSING COMMISSIONING

- .1 Departmental Representative to witness activities and verify results.

1.22 AUTHORITIES HAVING JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to Departmental Representative within 5 days of test and with Cx report.

1.23 COMMISSIONING CONSTRAINTS

- .1 Since access into secure or sensitive areas will be very difficult after occupancy it is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems in these areas before issuance of the Interim Certificate, using, if necessary, simulated thermal loads.

1.24 EXTRAPOLATION OF RESULTS

- .1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.25 EXTENT OF VERIFICATION

- .1 Laboratory areas:
 - .1 Provide manpower and instrumentation to verify up to 100 % of reported results.
- .2 Elsewhere:
 - .1 Provide manpower and instrumentation to verify up to 30 % of reported results, unless specified otherwise in other sections.
- .3 Number and location to be at discretion of Departmental Representative.

- .4 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .5 Review and repeat commissioning of systems if inconsistencies found in more than 20] of reported results.
- .6 Perform additional commissioning until results are acceptable to Departmental Representative.

1.26 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive Departmental Representative's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Departmental Representative deems Contractor's request for second verification was premature.

1.27 SUNDRY CHECKS AND ADJUSTMENTS

- .1 Make adjustments and changes which become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

1.28 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.
- .2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.29 COMPLETION OF COMMISSIONING

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.30 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.31 TRAINING

- .1 In accordance with Section 01 91 41 - Commissioning (Cx) - Training.

1.32 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.33 OCCUPANCY

- .1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

1.34 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Accuracy complies with these specifications.
 - .2 Calibration certificates have been deposited with Departmental Representative.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.35 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.
- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/- 2 % of recorded values.

1.36 OWNER'S PERFORMANCE TESTING

- .1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 Products

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 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete .

1.2 PERFORMANCE REQUIREMENTS

- .1 Product quality and quality of work in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets . Indicate VOC content.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal and the Waste Reduction Workplan.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away for children.
- .4 Dispose of surplus chemical and finishing materials in accordance with federal, provincial and municipal regulations.

1.5 ENVIRONMENTAL REQUIREMENTS

- .1 Temporary lighting:
 - .1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being treated.
- .2 Electrical power:
 - .1 Provide sufficient electrical power to operate equipment normally used during construction.
- .3 Work area:
 - .1 Make the work area water tight protected against rain and detrimental weather conditions.

- .4 Temperature:
 - .1 Maintain ambient temperature of not less than 10 degreesC from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.
- .5 Moisture:
 - .1 Ensure concrete substrate is within moisture limits prescribed by manufacturer.
- .6 Safety:
 - .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .7 Ventilation:
 - .1 Provide continuous ventilation during and after coating application.

Part 2 Products

2.1 SEALING COMPOUNDS

- .1 Surface sealer: water based , clear , dust proofing, hardening, and sealing compound.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify that slab surfaces are ready to receive work and are as indicated on instructed by manufacturer.

3.2 APPLICATION

- .1 Apply floor treatment in accordance with Sealer manufacturer's written instructions.
- .2 Clean overspray. Clean sealant from adjacent surfaces.

3.3 PROTECTION

- .1 Protect finished installation in accordance with manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

- .1 This Contractor shall provide all labour, materials, equipment, transportation and incidentals noted, specified or required, to complete the work of this Section to the full extent of the contract Drawings and Specifications.
- .2 The work to be performed by this Contractor shall be obtained by a careful examination of the detail Drawings and the Specifications.
- .3 Without limiting the generality of the foregoing, this work includes but is not limited to the following:
 - .1 Mortar.
 - .2 Concrete fill.
 - .3 Cold weather requirements.
 - .4 Hot weather requirements.
 - .5 Protection.
 - .6 Tolerances.
 - .7 Exposed masonry.
 - .8 Jointing.
 - .9 Cutting.
 - .10 Building-in.
 - .11 Loose steel lintels.
- .4 The summarized breakdown above does not limit the work of this Section. Any masonry work indicated on Drawings or hereinafter specified, all whether enumerated above or not shall be carried out by this Contractor.

1.2 RELATED SECTIONS

Masonry Mortar and Grout	Section 04 05 12
Masonry Anchorage and Reinforcing	Section 04 05 19
Masonry Accessories	Section 04 05 23
Concrete Unit Masonry	Section 04 22 00
Metal Fabrications: Steel lintels	Section 05 50 00
Sealants: Control Joints	Section 07 92 10

1.3 REFERENCES

- .1 The latest editions of the following codes and standards at time of tender shall apply unless otherwise indicated:

CSA A165	Standards on Concrete Masonry Units
CSA A179	Mortar and Grout for Unit Masonry.
CAN3-A371	Masonry Construction for Buildings.

1.4 REGULATIONS

- .1 Abide by current bylaws and regulations of the province and/or municipality in which the work is located, and abide by the current laws and regulations with regard to public safety.
- .2 Regulations of the Minister of Labour, Occupational Health and Safety Act and Regulations for Construction Projects, the Workers' Compensation Board and other applicable acts, administered by the authority having jurisdiction of the province apply to the work of this Section.

1.5 EXISTING CONDITIONS

- .1 Prior to the commencement of work, this Contractor shall examine all areas, which are to receive the work of this Section. All misalignments that may affect this work shall be reported to the General Contractor for correction.
- .2 Where new work connects to existing construction, determine existing conditions and all dimensions on site, including verification of all dimensions on Drawings. Report any necessary adjustments to Departmental Representative or Designate.

1.6 SUBMITTING

- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 Submittal Procedures.
- .2 Submit samples in accordance with 01 33 00 Submittal Procedures. Submit samples.

1.7 QUALIFICATIONS

- .1 All masonry work shall be completed by skilled workers experienced in projects of similar size and complexity and under the supervision and direction of skilled and experienced foremen in each branch of work. At least one thoroughly experienced and competent worker is to be in charge of mortar mixing.

1.8 RESPONSIBILITY

- .1 Review provided by Inspection and Testing Company or Departmental Representative or Designate does not relieve Contractor of its responsibility for quality control over work and to comply with the requirements of Drawings and Specifications. Performance or non-performance of Inspection and Testing Company shall not limit, reduce, or relieve Contractor of its responsibilities in complying with the requirements of the Specification.

- .2 Contractor is not relieved of any responsibility by absence of direction from Departmental Representative or Designate or Inspector regarding bracing or by approval or disapproval by Departmental Representative or Designate or Inspector of measures taken by Contractor.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to job site in dry condition.
- .2 Keep materials dry until use.
- .3 Store materials under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids. Protect from dirt and debris.
- .4 Repair or replace damaged materials due to improper handling or storage at no cost to the Owner. Do not hinder work of other trades. Deliver to conform to schedule.

1.10 ENVIRONMENTAL REQUIREMENTS

- .1 Cold weather requirements
 - .1 Supplement CSA-A371 with following requirements:
 - .1 Maintain temperature of mortar between 5°C and 50°C until batch is used. No frozen materials or masonry units containing ice shall be used in masonry construction.
 - .2 Masonry units shall have a temperature not less than -7°C when laid.
 - .3 Provide high-low registering thermometers.
 - .4 Make good any masonry damaged by frost.
 - .2 Air Temperature 4°C to 0°C.
 - .1 Sand or mixing water shall be heated to a temperature between 20°C and 70°C. Completed masonry shall be protected from rain, snow, ice or freezing for 48 hours.
 - .3 Air Temperature 0°C to -4°C.
 - .1 Sand and mixing water shall be heated to a temperature between 20°C and 70°C. Mortar temperatures shall be maintained above freezing on the boards. Completed masonry shall be completely covered with weather resistive membrane for 48 hours.

- .4 Air Temperature -4°C to -7°C.
 - .1 Sand and mixing water shall be heated to a temperature between 20°C and 70°C. Mortar temperatures shall be maintained above freezing on the boards. Salamanders or other sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 25 km/h (15 m.p.h.). Completed masonry shall be covered with insulating blankets for 48 hours.
- .5 Air Temperature -7°C. and below
 - .1 Sand and mixing water shall be heated to a temperatures between 20°C and 70°C. Enclosure and auxiliary heat shall be provided to maintain air temperature at 0°C. Temperature of units when laid shall not be less than 7°C. Completed masonry shall be maintained above 0°C for 48 hours by enclosure and supplementary heat.
- .2 Hot weather requirements
 - .1 Protect freshly laid masonry from drying too rapidly after consolidation, by means of wind & sun screens, and/or waterproof, non-staining coverings.
 - .2 When air temperature is above 38°C, or above 32°C with a wind velocity greater than 13 km/h (8 m.p.h.), then mortar beds shall not be spread more than 1200 mm (4'-0") ahead of masonry being placed, and masonry units shall be placed within one (1) minute of spreading mortar.

1.11 CO-OPERATION WITH WORK OF OTHER SECTIONS

- .1 This Contractor shall co-operate with all other trades on the work. Check Drawings and Specification for requirements of other Sections which affect installation of work of this Section.

1.12 PROTECTION

- .1 Keep masonry dry using waterproof, non-staining polyethylene sheets or tarpaulin coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, snow or ice and a minimum of 600 mm (24"), until masonry work is completed and protected by flashings or other permanent construction. Lap coverings a minimum of 300 mm (12") and properly secure protective coverings in place to prevent uplift due to high winds.
- .2 This Contractor shall construct and maintain temporary protection and lighting as required to permit continuous progress of the work. Protected areas shall be of sufficient size to permit progress of work in an orderly and efficient sequence of construction.
- .3 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

- .4 Protect masonry and other work from staining, marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .5 Protect exposed corners and projections from damage.
- .6 Protect work of other trades from damage resulting from work of this Section.

1.13 QUALITY ASSURANCE

- .1 Test Reports.
 - .1 Certified test reports showing compliance with specified performance characteristics and physical properties.
 - .2 Submit laboratory test reports in accordance Section 01 29 83 - Payment Procedures: Testing Laboratory Services.
 - .3 Submit laboratory test reports certifying compliance of masonry units and mortar ingredients with specification requirements.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Mock-ups.
 - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
 - .2 Construct mock-up panel of exterior masonry wall construction 1200 x 1800 mm showing masonry colours and textures, use of reinforcement, ties, through-wall flashing, weep holes, jointing, coursing, mortar and workmanship.
 - .3 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
 - .4 Construct mock-up where directed.
 - .5 Allow 24 hours for inspection of mock-up by Departmental Representative or Designate before proceeding with work.
 - .6 When accepted by Departmental Representative or Designate, mock-up will demonstrate minimum standard for this work. Mock-up may not remain as part of finished work.

Part 2 Products

2.1 MATERIALS

- .1 Masonry materials are specified in related Sections indicated in 1.3.

Part 3 Execution

3.1 INSTALLATION

- .1 Do masonry work in accordance with CAN3-A371 except where specified otherwise.

- .2 Build masonry plumb, level, square, and true to line and dimensions, with vertical joints in alignment.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.2 CONSTRUCTION

- .1 Exposed masonry
 - .1 Remove chipped, cracked, and otherwise damaged units, in accordance with CSA Z165, clause 82.1, in exposed masonry and replace with undamaged units.
 - .2 Jointing
 - .1 Allow joints to set just enough to remove excess water, then tool with round 16 mm (5/8") diameter non-staining plastic or stainless steel jointer to provide smooth, uniformly concave joint unless indicated otherwise. Joints shall be true to line, compressed, flush, and well bonded to the unit at edges.
 - .2 Where raked joints are indicated, allow joints to set just enough to remove excess water, then rake joints uniformly to 6 mm (1/4") depth and compress with square tool to provide smooth, compressed, raked joints of uniform depth.
 - .3 Strike flush all joints concealed in walls and joints in walls to receive tile, insulation, dampproofing or other applied material except paint or similar thin finish coating.
 - .4 Excess mortar and projections shall be removed. Care shall be taken to prevent breaking block corners and the tooled joints shall be made uniform on exposed work.
 - .5 Holes and cracks in exposed mortar joints shall be cut out, refilled solidly and repointed to match existing.
 - .3 Cutting
 - .1 Cut out accurately and neatly for electrical switches, outlet boxes, and other recessed or built-in objects.
 - .2 Make cuts straight, clean, free from uneven edges and neatly finished. Locate accurately.
 - .4 Building-In
 - .1 As the work progresses this Contractor shall solidly build into the masonry work, the following materials which are furnished by other trades and shall bed and secure same as required:

- .1 Masonry inserts, hangers, anchors, sleeves, bolts etc.
 - .2 Steel lintels bearing on the masonry work.
 - .3 Bearing plates.
 - .4 Door frames.
 - .5 Window frames.
 - .6 Installation of hollow metal frames and louvres.
 - .7 Miscellaneous inserts to support the work of other Sections.
 - .8 Flashing.
-
- .2 Grout build in items accurately, plumb, level, square, true, rigid and secure. Prevent displacement of build in items during construction. Check plumbness, location and alignment frequently, as work progresses. Set access doors with front face flush with final wall finish.
 - .3 Brace door jambs to maintain plumb fill spaces between jambs and masonry with mortar.
 - .4 Keep exposed faces of frames free of mortar. Fill spaces between doorframe jambs and masonry fully with mortar. Install in accordance with manufacturer's instruction. Maintain protective frame covering and ensure that no mortar is left on frame faces.
 - .4 Steel lintels shall be set dry to permit movement.
 - .5 Do not place dissimilar metals in contact with each other.
- .5 Support of loads
 - .1 Use 20 MPa concrete to Section 03 30 00 – Cast in Place Concrete, where concrete fill is used in lieu of solid units.
 - .2 Use 20 MPa grout to CSA-A179 where grout is used in lieu of solid units.
 - .3 Install building paper below voids to be filled with concrete or grout; keep paper 25 mm (1") back from faces of units.
 - .6 Loose steel lintels
 - .1 Install galvanized loose steel lintels and bearing plates. Centre over opening width. All steel beam lintels will be supplied under Section 05 12 23.
 - .2 Provide minimum 150 mm (6") bearing, unless indicated otherwise.
 - .7 Provision for movement
 - .1 Leave 3 mm (1/8") space below shelf angles.

- .2 Leave 50 mm (2”) space between top of non-load bearing walls and partitions and structural elements, unless noted otherwise. Do not use wedges. Pack joint solid with compressible joint filler strip compressed 25%. Set joint filler 6 mm (1/4”) back from each face of the masonry.
- .3 Built masonry to tie in with stabilizers, with provision for vertical movement.
- .4 Fire stopping and smoke sealing of joint at top of fire separations to Division 7.
- .8 Construction joints
 - .1 Provide horizontal construction joints in grouted or reinforced masonry when grouting is stopped for more than one (1) hour. Form a key in the joint by stopping the pour of grout not less than 25 mm (1”) from the nearest horizontal joint.
- .9 Control Joints
 - .1 Construct control joints as indicated.

3.3 TOLERANCES

- .1 Construction tolerances: to CAN3-A371.

3.4 RE-INSTALLATION

- .1 Cut openings in existing work as indicated.
- .2 Openings in walls to be approved by Departmental Representative or Designate.
- .3 Make good existing work. Use materials to match existing.

3.5 DEFECTIVE WORK

- .1 Variations in excess of specified tolerances, and failure of materials or workmanship to meet requirements of Drawings and Specification, will be considered defective work performed by this Section.
- .2 Replace defective work at no expense to Owner, as directed by Departmental Representative or Designate.
- .3 Contractor shall pay for additional inspection and testing, redesign, corrective measures, and related expenses if work is deficient. Costs for additional inspection and testing, review and redesign to be deducted from Contract Value.

3.6 CLEAN-UP

- .1 Upon completion of work of this Section, all surplus material and debris caused by work of this trade shall be removed from site to the satisfaction of Departmental Representative or Designate. Leave area clean for subsequent trades.

3.7 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.8 PREPARATION

- .1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.
- .2 Bracing approved by Departmental Representative or Designate.

3.9 FIELD QUALITY CONTROL

- .1 Inspection and testing will be carried out by Testing Laboratory designated by Departmental Representative or Designate.

3.10 PROTECTION

- .1 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

- .1 This Contractor shall provide all labour, materials, equipment, transportation and incidentals noted, specified or required, to complete the work of this Section to the full extent of the contract Drawings and Specifications.
- .2 The work to be performed by this Contractor shall be obtained by a careful examination of the detail Drawings and the Specifications.
- .3 Without limiting the generality of the foregoing, this work includes the mortars used in the masonry division, concrete and lightweight block.
 - .1 Mortar.
 - .2 Masonry grout.
 - .3 Portland cement.
 - .4 Masonry cement.
 - .5 Admixtures.
 - .6 Pointing.
- .4 The summarized breakdown above does not limit the work of this Section. Any masonry work indicated on Drawings or hereinafter specified, all whether enumerated above or not shall be carried out by this Contractor.

1.2 RELATED SECTIONS

- .1 Common Work Results for Masonry Section 04 05 00

1.3 REFERENCES

- .1 The latest editions of the following codes and standards at time of tender shall apply unless otherwise indicated:

CAN3-A5	Portland Cement.
CAN3-A8	Masonry Cement.
CAN3-A179	Mortar and Grout for Unit Masonry.

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00.

1.5 RESPONSIBILITY

- .1 Review provided by Inspection and Testing Company or Engineer does not relieve Contractor of its responsibility for quality control over work and to comply with the requirements of Drawings and Specifications. Performance or non-performance of Inspection and Testing Company shall not limit, reduce, or relieve Contractor of its responsibilities in complying with the requirements of the Specification.

- .2 It shall be the responsibility of the Contractor to make good any work that includes mortars not meeting the required specification. This shall include the removal of all walls affected and the reconstruction of such walls in new materials. Such work or any additional testing required will be at Contractor's expense.

1.6 QUALITY ASSURANCE

- .1 An Independent Inspection and Testing Company appointed by Parks Canada Agency shall carry out inspections and testing as required. It is Contractor's responsibility to notify Inspection and Testing Company in advance, to request the required inspection or test.
- .2 Materials and workmanship shall be subject inspection at any time by qualified inspectors. Provide access for inspection to all places the where work is being manufactured, stockpiled or installed.
- .3 Additional costs for extra testing and inspection due to deficiencies shall be paid by this Contractor.

1.7 INSPECTION AND TESTING COMPANY RESPONSIBILITIES

- .1 An Independent Inspection and Testing Company appointed by Parks Canada Agency shall carry out inspections and testing as required by this Section.
- .2 Inspection and Testing Company will work with Contractor with regards to timing of inspection and testing and will report directly to Departmental Representative or Designate representing Parks Canada Agency. In no case shall the decisions and operations of Inspection and Testing Company be influenced by Contractor.
- .3 Inspection and Testing Company shall immediately inform Contractor, verbally, of any material, construction procedure or test result that does not meet the requirements of the Specification. Confirm deficiencies in writing to Contractor and Departmental Representative or Designate. Departmental Representative or Designate shall be promptly informed of any questionable construction practices.
- .4 Inspection and Testing Company is not authorized to revoke, relax, enlarge or release any requirements of the Specification.
- .5 Submit inspection and testing reports to Contractor and to Departmental Representative or Designate for review while work of this Section is in progress. Indicate the location and results of tests or inspections, and include instructions or recommendations given on site. Report shall be signed by inspector who performs inspection, and describe progress of work, deficiencies found and corrective actions taken.
- .6 Include deficiency list of outstanding items from previous reports, indicate date of first observation and date of corrective action, and comment on status.

1.8 SOURCE QUALITY CONTROL

- .1 Submit laboratory test reports certifying compliance of mortar ingredients with specification requirements.

1.9 NOTICE

- .1 Provide Independent Inspection Company with a minimum of 24 hours notice prior to the inspection required.

1.10 DELIVERY AND STORAGE OF MATERIALS

- .1 All cement, lime and other packaged materials shall be delivered in original unbroken and undamaged packages with the manufacturer name and brand distinctly marked. Upon delivery store in a shed until used on the work.
- .2 Sand shall be stored or piled on a plank platform and shall be protected from dirt and rubbish. Mortar materials and sand shall be stored in such a manner to prevent deterioration or contamination by foreign materials.

Part 2 Products

2.1 MATERIALS

- .1 Use same brands of materials and source of aggregate for entire project.
- .2 Mortar and grout: to CSA-A179.
- .3 Grout: to CSA-A179, Table 3 for masonry block, bond beams and lintel blocks shall have minimum compressive strength of 20 MPa at 28 days and a maximum coarse aggregate size of 10 mm (3/8"). Maximum slump shall be 225 ± 25 mm (9 ± 1 "). Concrete exposed to freezing and thawing shall have 5 to 8 % air entrainment.
- .4 Portland Cement: shall be freshly made Portland Cement , complying with CAN3-A5.
- .5 Masonry Cement: shall be freshly made masonry cement complying with CAN3-A8.
- .6 Sand: shall be natural pit sand consisting of clean, dry, sharp, gritty, particles of hard, durable stone, graded from fine to coarse to the approval of the Departmental Representative. Sand shall be free from frozen material, loam, clay, organic material, acid, alkali, salt or other solutions or deleterious material.
- .7 Water: shall be potable, clean and free of deleterious amounts of acid, alkali, salts or organic materials.
- .8 Colour: ground coloured natural aggregates or metallic oxide pigments, non-fading and non-staining.
- .9 Plasticizer: shall be added to all mortar mixes in accordance with manufacturer's instructions.

- .10 Mortar for exterior masonry above grade:
 - .1 Loadbearing: Type S based on Property specifications and in accordance with CSA-A179. Minimum compressive strength at 28 days shall be 10.0 MPa.
 - .2 Non-loadbearing: Type S based on Property specifications and in accordance with CSA-A179. Minimum compressive strength at 28 days shall be 10.0 MPa.
 - .3
- .11 Mortar for interior masonry:
 - .1 Loadbearing: Type S based on Property specifications and in accordance with CSA-A179. Minimum compressive strength at 28 days shall be 10.0 MPa.
 - .2 Non-loadbearing: Type N based on Property specifications and in accordance with CSA-A179. Minimum compressive strength at 28 days shall be 4.0 MPa.
- .12 Coloured mortar: where indicated shall use colouring admixture not exceeding 5% of cement content by mass, or integrally coloured masonry cement, to produce coloured mortar to match approved sample.
- .13 White mortar: where indicated shall use white Portland cement and lime to produce mortar type specified.
- .14 Non-staining mortar: use non-staining masonry cement for cementitious portion of specified mortar type.

2.2 MIXES

- .1 Grout: do masonry mortar and grout work in accordance with CSA-A179 except where specified otherwise.
- .2 Pointing mortar: Prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour nor more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.

Part 3 Execution

3.1 CONSTRUCTION

- .1 Do masonry mortar and grout work in accordance with CSA-A179 except where specified otherwise.
- .2 All cementitious materials and aggregate shall be mixed by machine on the job site for at least 5 minutes in a mechanical batch mixer, to CSA-A179 and in also accordance to the mixing procedure recommended by the manufacturer of the packaged components. Use

the minimum amount of water to produce a mix with a workable consistency, maximum bond strength and that is impermeable to moisture.

- .3 Do not mix in greater quantities than required for immediate use and clean mixer between batches.
- .4 Structural mortars shall not be retempered.
- .5 Mortar shall be used within 1-1/2 hours after initial mixing when air temperature is at or above 25 °C and within 2-1/2 hours when air temperature is below 25 °C. Grout shall be used and placed in final position within 1-1/2 hours after initial mixing, and before initial set has taken place. Discard mortar and grout not used within stated time.
- .6 Grouted masonry shall be built so that walls, cross webs, and head joints are fully bedded in mortar to prevent leakage of grout. The vertical cells of hollow units to be filled shall have vertical alignment to maintain an unobstructed continuous cell of at least 50 x 75 mm (2" x 3"). Hollow units shall be grouted and vibrated in low lifts not more than 1500 mm (5'-0"). Reinforcement shall be in place prior to grouting.
- .7 Grout shall be poured or pumped into place without segregation and readily flow around the reinforcement steel, and into corner and joints with no voids remaining.
- .8 Calcium chloride or admixtures containing calcium shall not be used in mortar or grout in which reinforcement, metal ties or anchors are embedded, or in walls containing hollow metal door frames.
- .9 No air-entraining admixtures or cementitious materials containing air-entraining admixtures shall be used in the mortar, unless indicated otherwise.
- .10 No antifreeze compounds or other substances shall be used in the mortar to lower the freezing point.
- .11 Excess mortar and projections shall be removed.
- .12 Pointing and repointing: to CSA-A371. Holes and cracks in exposed mortar shall be pointed and filled. Before pointing or repointing, the mortar shall be raked out 2 to 2 ½ times the joint thickness. Remove all loose mortar and mortar from both surfaces of the adjacent masonry and saturate joints with clean water. After the free surface water has been absorbed, the joints shall be filled with a well compacted mortar compatible with the existing unit and mortar. Tool to form a neat joint to match existing.

3.2 FIELD QUALITY CONTROL

- .1 The Independent Testing Company will conduct testing of mortar and masonry grout in accordance with CSA-A179.
- .2 Inspection and testing of materials and workmanship of work of this Section, may be performed by an Inspection and Testing Company appointed by Parks Canada Agency.

- .1 Inspection and Testing Company to take a minimum of three (3) 50 mm (2") mortar cube compressive strength tests for each 500 m² of masonry or portion thereof for a project having more than 500 m² of masonry and for each 250 m² of masonry or portion thereof for a project having less than 500 m² and not less than one (1) test in any one day of masonry placed.
- .2 Inspection and Testing Company to take a minimum of three (3) compressive strength test cylinders, one slump test and one entrained air test for each 20 m³ placed or portion thereof for a project having more than 20 m³ of grout and for each 10 m³ placed or portion thereof for a project having less than 20 m³ and not less than one (1) test in any one day of grout placed.
- .3 Masonry grout compressive strength tests shall be made with one (1) at 7 days and two (2) at 28 days.
- .4 Mortar compressive strength tests shall be made with three (3) at 7 days and three (3) at 28 days.
- .5 Inspection and Testing Company to confirm by written report that masonry work meets requirements specified. Indicate in test report the location at which the specimens were taken.

3.3 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

- .1 This Contractor shall provide all labour, materials, equipment, transportation and incidentals noted, specified or required, to complete the work of this Section to the full extent of the contract Drawings and Specifications.
- .2 The work to be performed by this Contractor shall be obtained by a careful examination of the detail Drawings and the Specifications.
- .3 Without limiting the generality of the foregoing, this work includes but is not limited to the following:
 - .1 Reinforcing bars.
 - .2 Reinforcing wire.
 - .3 Masonry ties.
 - .4 Connectors.
 - .5 Lintels.
 - .6 Bond beams.
- .4 The summarized breakdown above does not limit the work of this Section. Any masonry work indicated on Drawings or hereinafter specified, all whether enumerated above or not shall be carried out by this Contractor.

1.2 RELATED WORK

- | | |
|---|------------------|
| .1 Common Work Results for Masonry | Section 04 05 00 |
| .2 Masonry Mortar and Grout | Section 04 05 12 |

1.3 REFERENCES

- .1 The latest editions of the following codes and standards at time of tender shall apply unless otherwise indicated:
 - .1 CAN/CSA-A23.1/A23.2 Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
 - .2 CSA3-A370 Connectors for Masonry.
 - .3 CSA3-A371 Masonry Construction for Buildings.
 - .4 CSA-G30.3 Cold-Drawn Steel Wire for Concrete Reinforcement.
 - .5 CSA-G30.14 Deformed Steel Wire for Concrete Reinforcement.
 - .6 CSA-G30.18 Billet-Steel Bars for Concrete Reinforcement.
 - .7 CAN/CSA-G164 Hot dip galvanizing of irregularly shaped articles.
 - .8 CSA-S304.1 Masonry Design for Buildings - Limit States Design.

- | | | |
|-----|---------------------------|--|
| .9 | CSA-W186
Construction. | Welding of Reinforcing Bars in Reinforced Concrete |
| .10 | CSA-A179 | Mortar and Grout for Unit Masonry |

1.4 SHOP DRAWINGS

- .1 Submit four (4) sets of shop drawings in accordance with Section 01 33 00.
- .2 Departmental Representative or Designate will review and return shop drawings in accordance with an agreed schedule. Review of shop drawings by Departmental Representative or Designate is for the sole purpose of ascertaining conformance with the general design concept and does not relieve the Contractor of responsibility for errors and omissions in shop drawings or for making the work accurate and in compliance with all articles of contract documents and contract Drawings.
- .3 Shop drawings consist of bar bending details, lists and placing drawings.
- .4 On placing drawings, indicate bar bending details sizes, spacing, location and quantities of reinforcement and connectors, with identifying marks to permit correct placement without reference to structural Drawings. Indicate sizes, spacing and location of chairs, spacers and hangers. Do drawings in accordance with the Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .5 Prior to submission to Departmental Representative or Designate, Contractor shall review all shop drawings. By this review, Contractor represents to have determined and verified all field measurements, site conditions, materials, catalogue numbers and similar data, and to have checked and coordinated each shop drawing with the requirements of work and of contract documents. Contractor's review of each shop drawing shall be indicated by stamp, date and signature of the Contractor's representative.
- .6 At time of submission, Contractor shall notify Departmental Representative or Designate in writing of any deviations in shop drawings from requirements of contract documents.
- .7 Contractor shall make changes in shop drawings, which Departmental Representative or Designate may require, consistent with contract documents, and resubmit unless otherwise directed by Departmental Representative or Designate. When resubmitting, Contractor shall notify Departmental Representative or Designate in writing of revisions other than those requested by Departmental Representative or Designate.
- .8 Fabrication prior to receipt of shop drawing review comments is at the risk of the Contractor.

1.5 RESPONSIBILITY

- .1 Review provided by Inspection and Testing Company or Departmental Representative or Designate does not relieve Contractor of its responsibility for quality control over work and to comply with the requirements of Drawings and Specifications. Performance or non-performance of Inspection and Testing Company shall not limit, reduce, or relieve Contractor of its responsibilities in complying with the requirements of the Specification.

1.6 QUALITY ASSURANCE

- .1 An Independent Inspection and Testing Company appointed by Parks Canada Agency shall carry out inspections and testing as required. It is Contractor's responsibility to notify Inspection and Testing Company in advance, to request the required inspection or test.
- .2 Materials and workmanship shall be subject to inspection at any time by qualified inspectors. Provide access for inspection to all places the where work is being manufactured, stockpiled or installed.
- .3 Additional costs for extra testing and inspection due to deficiencies shall be paid by this Contractor.

1.7 INSPECTION AND TESTING COMPANY RESPONSIBILITIES

- .1 An Independent Inspection and Testing Company appointed by Parks Canada Agency shall carry out inspections and testing as required by this Section.
- .2 Inspection and Testing Company will work with Contractor with regards to timing of inspection and testing and will report directly to Departmental Representative or Designate representing Parks Canada Agency. In no case shall the decisions and operations of Inspection and Testing Company be influenced by Contractor.
- .3 Inspection and Testing Company shall immediately inform Contractor, verbally, of any material, construction procedure or test result that does not meet the requirements of the Specification. Confirm deficiencies in writing to Contractor and Departmental Representative. Departmental Representative or Designate shall be promptly informed of any questionable construction practices.
- .4 Inspection and Testing Company is not authorized to revoke, relax, enlarge or release any requirements of the Specification.
- .5 Submit inspection and testing reports to Contractor and to Departmental Representative or Designate for review while work of this Section is in progress. Indicate the location and results of tests or inspections, and include instructions or recommendations given on site. Report shall be signed by inspector who performs inspection, and describe progress of work, deficiencies found and corrective actions taken.

- .6 Include deficiency list of outstanding items from previous reports, indicate date of first observation and date of corrective action, and comment on status.

1.8 SOURCE QUALITY CONTROL

- .1 Upon request, provide Departmental Representative or Designate with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum four (4) weeks prior to commencing reinforcement work.
- .2 Submit copies of test reports demonstrating that masonry connectors and their fasteners comply with specified performance characteristics and criteria and physical requirements of CSA-A370.
- .3 Upon request, inform Departmental Representative or Designate of proposed source of material to be supplied.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, handle, and store reinforcement, connectors, ties, and anchors off the ground to protect them from damage, bending, scratching, or contamination from oil, dirt, or other foreign matter. Protective coatings which have been damaged shall be restored.

Part 2 Products

2.1 MATERIALS

- .1 Bar reinforcement: to CSA-A371 and CSA-G30.18, Grade 400.
- .2 Wire reinforcement: to CSA-A371 and CSA-G30.3, truss type.
- .3 Horizontal masonry reinforcing: in accordance to CSA-A370 and shall be heavy duty 4.76 mm (3/16") wire, truss type with width 50 mm (2") less than the wall thickness, hot dipped galvanized after fabrication with a minimum coating of 458g/m² to ASTM A 153, Class B-2. Unless indicated otherwise on Drawings, the following horizontal reinforcing shall apply.
 - .1 Single wythe walls: Ladder Type, minimum No. 9 ga. side and cross rods, flush welded steel rod, mill galvanized except inner wythe of exterior wall shall be hot-dipped galvanized.
 - .2 For corners and intersecting walls use special corner sections and tee-sections to match truss type reinforcing.
- .4 Adjustable wire ties: in accordance to CSA-A370 and shall be fabricated with 4.76 mm (3/16") wire, galvanized after fabrication with a minimum coating of 458 g/m² to ASTM A 153, Class B-2.

- .5 Adjustable anchors: in accordance to CSA-A370 and shall be fabricated with 6.35 mm (1/4") wire, galvanized after fabrication with a minimum coating of 458 g/m² to ASTM A 153, Class B-2.
- .6 Conventional masonry anchors: to CSA A370, 4.76 mm (3/16") thick, galvanized with a minimum coating of 458 g/m² to ASTM A 153, Class B-2.
- .7 Connectors: to CSA-A370 and CSA-S304.1.
- .8 Corrosion protection: to CSA-S304.1, hot dip galvanized.

2.2 FABRICATION

- .1 Fabricate reinforcing in accordance with the requirements and tolerances of CSA-A370, CSA-A371, CAN/CSA-A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada. The diameter of reinforcement shall not exceed one half of the least clear dimension of the cell, core, bond beam, or collar joint in which it is placed.
- .2 The diameter of joint reinforcement shall not be less than 3.0 mm, and shall not be greater than half the joint thickness.
- .3 Fabricate connectors in accordance with CSA-A370.
- .4 Obtain Departmental Representative's or Designate's approval for locations of reinforcement splices other than shown on the placing drawings.
- .5 Upon approval of Departmental Representative or Designate, weld reinforcement in accordance with CSA-W186.
- .6 Ship reinforcement and connectors, clearly identified in accordance with the placing drawings.

Part 3 Execution

3.1 GENERAL

- .1 Do masonry connectors and reinforcement in accordance with the requirements and tolerances of CSA-A370, CSA-A371, CAN/CSA-A23.1 and CSA-S304.1 unless indicated otherwise.
- .2 Reinforcement shall be free from dirt, oil, grease, or other foreign materials prior to placing mortar or grout.
- .3 Prior to placing concrete or grout, obtain Departmental Representative's or Designate's approval of placement of reinforcement and connectors.
- .4 Do additional reinforcement of masonry as indicated.

- .5 Do not place dissimilar metals on contact with each other.
- .6 Supply metal anchors to the appropriate trades for placement. Direct correct placement.
- .7 Verify that anchors attached to structural steel members are properly placed in accordance with this Section.

3.2 CONNECTION TO EXISTING WORK

- .1 Verify dimensions and condition of existing work prior to erection, report any discrepancy and potential problem areas to Departmental Representative for direction before commencing work.

3.3 MASONRY REINFORCEMENT

- .1 All masonry walls shall be continuously reinforced horizontally every second block bed joint (400 mm (15 ¾”) o/c vertically). Ties shall be spaced not greater than 800 mm (31 ½”) o/c horizontally and 400 mm (15 ¾”) o/c vertically.
- .2 Horizontal reinforcement shall be fully embedded in mortar and lapped a minimum of 150mm (6”) at splices for knurled rods, 300 mm (12”) for plain rods and cut and bent at corners. Lapped rods shall be placed side by side in mortar joints and have laps staggered at least 750 mm (30”) from course to course. Overall width of reinforcement shall be according to the manufacturer's recommendations for the various wall thickness.
- .3 Horizontal reinforcement shall be placed in first two (2) consecutive bed joints above and below openings. The reinforcing shall extend 600mm (24”) beyond each side of the opening.
- .4 Provide continuous reinforcement at the first two beds below the top of the wall, below roof level and above floor level.
- .5 Horizontal joint reinforcement and ties shall have a minimum 16 mm (5/8”) cover at the exterior face and a minimum of 13 mm (1/2”) cover at the interior face.
- .6 Reinforcement shall be supported and fastened together to prevent displacement due to construction loads, and placing of grout or mortar. Immediately reset displaced elements.
- .7 Install vertical reinforcing where indicated on Drawings, at all openings, corners and ends of walls, and control joints. Dowels in foundation walls shall match vertical reinforcing and additional reinforcing at openings, corners and ends of walls and control joints.
- .8 Vertical reinforcement shall have a minimum clearance of 12 mm (1/2”) from the masonry. The clear distance between parallel bars shall not be less than 25 mm (1”) , except bars in a splice may be in contact. The clear distance between two or more layers shall not be less than 25 mm (1”). Reinforcement shall be in place prior to grouting.

- .9 Fill voids in block where vertical reinforcing or anchor bolts occur with 20 MPa grout. Ensure voids are completely filled, and grout is consolidated around all reinforcement by vibrating.

3.4 BONDING AND TYING

- .1 Bond walls of two or more wythes using metal connectors in accordance with NBC, CSA-S304, CSA-A371 and as indicated.
- .2 Tie masonry veneer to backing in accordance with NBC, CSA-S304, CSA-A371 and as indicated.

3.5 GROUTING

- .1 Grout masonry in accordance with CSA-S304, CSA-A371 and CSA A179 and as indicated.

3.6 METAL ANCHORS

- .1 Do metal anchors as indicated.

3.7 LINTELS AND BOND BEAMS

- .1 Unless otherwise noted, reinforced block lintels shall be provided by Contractor for full thickness of the wall.
- .2 Minimum end bearing of all lintels shall be 200mm (8”).
- .3 Reinforce bond beams as indicated on Drawings. Position and support so that reinforcing remains in position while pouring and is fully surrounded by grout or concrete. Where not indicated minimum reinforcement shall be 2 – 10 M bars continuous.
- .4 Place and grout reinforcement in accordance with CSA-S304.

3.8 LATERAL SUPPORT AND ANCHORAGE

- .1 Supply and install lateral support and anchorage in accordance with CSA-S304.1 and as indicated.

3.9 CONTROL JOINTS

- .1 Terminate horizontal wire reinforcement 25 mm (1”) clear of each side of control joints unless otherwise indicated. Bond beam reinforcement shall not be continuous through control joints unless otherwise indicated. Refer to Section 04 05 00 for additional control joint requirements.

3.10 TOLERANCES

- .1 Place reinforcement, connectors, ties and anchors to CSA-A370 and CSA-A371.

3.11 FIELD BENDING

- .1 Do not field bend reinforcement and connectors except where indicated or authorized by Departmental Representative or Designate.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars and connectors which develop cracks, splits, kinks or bends.

3.12 FIELD QUALITY CONTROL

- .1 Inspection and testing of materials and workmanship of work of this Section, may be performed by an Inspection and Testing Company appointed by Departmental Representative or Designate to verify:
 - .1 The location, spacing, and concrete cover of reinforcement, splices, bar supports, spacers, ties, connectors, anchors and embedded or cast in items prior to grout placement.

3.13 FIELD TOUCH-UP

- .1 Touch-up damaged and cut ends of galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

3.14 MANUFACTURER'S INSTRUCTIONS

- .2 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

- .1 This Contractor shall provide all labour, materials, equipment, transportation and incidentals noted, specified or required, to complete the work of this Section to the full extent of the contract Drawings and Specifications.
- .2 The work to be performed by this Contractor shall be obtained by a careful examination of the detail Drawings and the Specifications.
- .3 Without limiting the generality of the foregoing, this work includes but is not limited to the following:
 - .1 Control joints in masonry.
 - .2 Lap adhesive.
 - .3 Weephole vents.
 - .4 Mechanical fasteners.
 - .5 Cavity insulation.
 - .6 Masonry flashing.
 - .7 Air and vapour barrier membrane.
- .4 The summarized breakdown above does not limit the work of this Section. Any masonry work indicated on Drawings or hereinafter specified, all whether enumerated above or not shall be carried out by this Contractor.

1.2 RELATED SECTIONS

Common Work Results for Masonry	Section 04 05 00
Masonry Anchorage and Reinforcing	Section 04 05 19
Cast in Place Concrete	Section 03 30 00

1.3 REFERENCES

- .1 The latest editions of the following codes and standards at time of tender shall apply unless otherwise indicated:

CSA3-A371	Masonry Construction for Buildings.
ASTM D 2240	Test Method for Rubber Property - Durometer Hardness.

Part 2 Products

2.1 MATERIALS

- .1 Control joint filler: purpose-made to ASTM D 2240 of size and shape indicated.
- .2 Lap adhesive: recommended by masonry flashing manufacturer.

- .3 Wall flashings: 40 mil thick, rubberized asphalt membrane bonded to cross-laminated polyethylene film.
- .4 Air and vapour barrier membrane: 40 mil thick, self-adhering, rubberized asphalt membrane bonded to cross-laminated polyethylene film, primer as recommended.

Part 3 Execution

3.1 INSTALLATION

- .1 Install continuous control joint fillers in control joints at locations indicated.
- .2 Install weep hole vents in the vertical joints of the first course immediately over flashings, and above shelf angles in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 800 mm (31 ½”) o/c. Keep face of insert back from the face a minimum of 6 mm (1/4”), and keep free of mortar.

3.2 CONSTRUCTION

- .1 Build in flashings in masonry in accordance with manufacturer’s recommendations and CAN3-A371 as follows:
 - .1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, window sills and steel angles over openings. Install flashings under weep hole courses and as indicated. Slope to drain toward outside wythe and extend flashing minimum 6 mm (1/4”) beyond outer face of element below.
 - .2 In cavity walls and veneered walls, carry flashings from front edge of masonry, under outer wythe, then up backing not less than 200 mm (8”), and as follows:
 - .1 For masonry backing embed flashing 25 mm (1”) in joint.
 - .2 For concrete backing, insert flashing into reglets and caulk.
- .3 Lap joints 150 mm (6”) and seal with compatible adhesive.
- .4 Flashing over openings shall have “dams” at both ends to prevent water from travelling horizontally past the flashing ends.
- .5 Horizontal base flashing shall be returned a minimum of 100 mm (4”) around corner to overlap abutting flashing. Overlapped flashing shall be sealed with compatible adhesive.
- .6 Protect base wall flashing from mortar droppings and damage.

3.3 AIR AND VAPOUR BARRIER MEMBRANE

- .1 Install membrane in accordance with manufacturer’s recommendations. Inspect all surfaces to receive membrane to ensure they are continuous, flush and free of voids or excessive gaps, clean, dry and free of contaminants that may impair adhesion. Report any deficiencies to Contractor for correction.

- .2 Prime all surfaces to receive membrane using manufacturer primer applied by means of roller or spray. Allow primer to dry adequately before installation of membrane.
- .3 Apply membrane horizontally to primed block work between projecting masonry ties. Overlap sheets a minimum of 50 mm (2"). Stagger all vertical joints.
- .4 Seal Membrane around all projections and penetrations using adhesive or mastic.
- .5 Membranes are not designed for permanent exposure. Cover membrane as soon as possible and within manufacturer exposure limits.
- .6 Before covering membrane with cavity insulation, inspect and repair as necessary any punctures, damaged areas or inadequately lapped seams. Size repair membrane to extend a minimum 100 mm (4") in all directions from the perimeter of affected area.

3.4 CAVITY INSULATION

- .1 Supply and install cavity wall insulation as specified under Division 07.

3.5 MANUFACTURER'S INSTRUCTIONS

- .5 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

- .1 This Contractor shall provide all labour, materials, equipment, transportation and incidentals noted, specified or required, to complete the work of this Section to the full extent of the contract Drawings and Specifications.
- .2 The work to be performed by this Contractor shall be obtained by a careful examination of the detail Drawings and the Specifications.
- .3 Without limiting the generality of the foregoing, this work includes but is not limited to the following:
 - .1 Concrete block and lightweight block.
 - .2 Reinforced concrete block lintels.
 - .3 Bond beams.
 - .4 Control joints in masonry.
 - .5 Cleaning.
- .4 The summarized breakdown above does not limit the work of this Section, but rather outlines the essential work. Any masonry work indicated on Drawings or hereinafter specified, whether enumerated above or not, shall be carried out by this Contractor.

1.2 RELATED SECTIONS

Common Work Results for Masonry	Section 04 05 00
Masonry Mortar and Grout	Section 04 05 12
Masonry Anchorage and Reinforcing	Section 04 05 19
Masonry Accessories	Section 04 05 23

1.3 REFERENCES

- .1 The latest editions of the following codes and standards at time of tender shall apply unless otherwise indicated:

CSA-A165 Series	Standards on Concrete Masonry Units.
CSA-A370	Connectors for Masonry.
CSA-A371	Masonry Construction for Buildings.
CSA-S304.1	Design of Masonry Structures.
OBC	Ontario Building Code.

1.4 EXISTING CONDITIONS

- .1 Prior to the commencement of work, this Contractor shall examine all areas, which are to receive the work of this Section. All misalignments that may affect this work shall be reported to the Contractor for correction.

- .2 The Contractor should note that site conditions may require adjustment to counteract variations due to minor inaccuracies. It is the responsibility of this Contractor to make such necessary site adjustments to ensure the proper fit and coursing of the masonry.
- .3 Where new work connects to existing construction, determine existing conditions and all dimensions on site, including verification of all dimensions on Drawings. Report any necessary adjustments to Departmental Representative or Designate.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 All concrete block shall be delivered to the site in an approved protective film and be covered with protective tarpaulins and kept dry at all times.
- .2 Masonry units shall be stored off the ground on skids, and handled with care to avoid damage to edges and corners, soiling or any other deterioration. Units shall be clean, and free from cracks when placed. Damaged units will not be acceptable for face work.

1.6 SOURCE QUALITY CONTROL

- .1 Submit laboratory test reports certifying compliance of masonry units with specification requirements, if required.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

- .1 Concrete Block: Member of the Ontario Concrete Block Association

2.2 MATERIALS

- .1 Obtain units from a single manufacturer throughout the project, true to size, uniform in texture, colour and aggregate, free from stains, edge defects and imperfections and cured by one process.
- .2 Standard or “autoclave” normal weight aggregate hollow concrete block units to CSA-A165 Series (CSA-A165.1).
 - .1 Classification: H/15/A/M. Minimum compressive strength shall be 15 MPa.
 - .2 Size: metric modular, with two cores.
- .3 Standard or “autoclave” normal weight aggregate solid concrete block units to CSA-A165 Series (CSA-A165.1).
 - .1 Classification: S/15/A/M. Minimum compressive strength shall be 15 MPa.
 - .2 Size: metric modular.
- .4 Linear shrinkage and moisture movement shall not exceed 0.03%.

- .5 Special shapes: provide bull nosed and plain end units for exposed corners. Provide plain blocks, halves, jamb blocks, purpose-made shapes for lintels and bond beams and additional special shapes as required.
- .6 Concrete unit masonry shall conform to CSA-A165 Series (CSA-A165.1). Refer to Architectural Drawings for unit types, colour, quantity and location.
- .7 All damaged units are the responsibility of Contractor to make good.
- .8 Cleaning compound: as recommended by the masonry manufacturer. Material selected shall have no harmful after effects or chemical reaction on surface or texture of masonry or mortar.

Part 3 Execution

3.1 PREPARATION

- .1 Examine installed work of other trades and verify that such work is complete to the point that this work may properly begin.
- .2 Verify that dowels are positioned in accordance with Drawings and that foundation walls are constructed within tolerances specified. Remove laitance, loose aggregate, or foreign material that would prevent mortar from bonding.

3.2 INSTALLATION

- .1 Units shall be laid to vertical courses indicated in a full bed of mortar, plumb, level, square and true in line and dimensions, and properly jointed with other connecting work. Ensure joints are in proper alignment. All angles and reveals shall be at right angles to faces unless indicated otherwise. Units with open cells exposed in walls will not be permitted.
- .2 First course shall be laid in a full bed. All grouted block work shall be laid with a full mortar bed on face shells and cross webs, and all other block work shall be laid with a full mortar bed on face shells. Fill all vertical joints solid with mortar.
- .3 Lay units in fresh, plastic mortar. Over-plumbing and pounding of the corners and jambs to fit stretcher units after they are set in position shall not be allowed. Where an adjustment must be made after the mortar has started to harden, the mortar shall be removed and replaced with fresh mortar, then the units shall be positioned again.
- .4 All corners and intersection of walls and intersection of partitions providing lateral support shall be bonded to the supporting walls by laying true bond 50 % of the units in each wall.
- .5 Do not bond interior partitions at intersection with exterior wall. Provide control joints, prefabricated wall anchors and reinforcement as indicated.

- .6 Unless clearly shown otherwise on Drawings, non-load bearing partitions in all cases shall extend from the top of the structural floor to the bottom surface of the floor or roof construction above. Refer to Section 04 05 00 for additional provisions for movement requirements.
- .7 No portion of any wall shall be carried up more than 900 mm (36”) above any other portion of wall at any time.
- .8 Use solid blocks for at least three (3) courses under point bearing loads. Ensure solid units continue 200 mm (8”) either side of bearing or as noted on Drawings.
- .9 Pass piping and conduits through hollow cells of blocks or build around with split blocks. No pipe, conduit chases or enclosures shall be covered until advised that the work has been inspected and tested.
- .10 Where required, cut concrete masonry units dry with motor driven saw designed for such use. No ragged or chipped edges will be permitted.
- .11 Exercise care to keep wall cavities free of mortar. Strike cavity side of wall flush to provide smooth surface for insulation.
- .12 Keep all exposed masonry surfaces clean as the work proceeds, leaving no mortar fins or droppings. Masonry exposed to view or to receive a brushed or sprayed on finish shall be laid carefully and evenly with exposed faces flush and even throughout. No cracked, broken corners or spoiled units will be permitted.
- .13 Rake back half block length in each course when necessary to “stop off” a horizontal run. When work is resumed, remove loose units, clean contact surfaces of mortar and debris.

3.3 CONCRETE BLOCK UNITS

- .1 Bond: running.
- .2 Coursing height: to be uniform height of 200 mm (7 7/8”) for one block and one joint. Both vertical and horizontal joints to be equal and uniform thickness. Fill all vertical and bed joints solidly with mortar. Do not shift or tap units after mortar has set. Care shall be taken to prevent breaking or chipping block corners. Remove and replace any damaged units evident in finished wall.
- .3 Jointing: concave where exposed or where paint or other finish coating is specified. Joints shall be tooled with a 16 mm (5/8”) non-staining plastic or stainless steel jointer when the mortar has become thumbprint hard. Holes and cracks in exposed mortar joints shall be cut out, refilled solidly and repointed to match existing.

3.4 REINFORCED CONCRETE BLOCK LINTELS AND BOND BEAMS

- .1 Install reinforced concrete block lintels to match wall thickness over openings in masonry where steel or reinforced concrete lintels are not indicated. Provide 200 mm (7 7/8”) or 400 mm (15 3/4”) deep concrete block lintel units as indicated. Fill voids of units with grout and provide reinforcement as indicated on Drawings.
- .2 End bearing: not less than 200 mm (8”) unless indicated otherwise on Drawings.
- .3 Provide bond beams at top course of all walls immediately below roof or floor.
- .4 Reinforce bond beams as indicated on Drawings. Where not indicated the minimum reinforcement shall be 2 – 10M bars continuous.
- .5 Grout lintels and bond beams and lintel blocks with 20 MPa concrete grout.
- .6 Support and brace blocks lintels level and secure to prevent movement or deflection during the curing period. Allow block lintels to cure at least seven (7) days before applying load.

3.5 CONTROL JOINTS

- .1 Control joints shall be placed in accordance with good masonry practice at a maximum spacing of 7.2 m (23’-8”) o/c and carried full height in walls and as follows:
 - .1 Full height at intersections of loadbearing and non-loadbearing walls.
 - .2 All locations where the wall height changes by more than 20 %.
 - .3 Over joints in the floor slab.
 - .4 At joints in foundation wall.
 - .5 At joints in roof.
 - .6 In partitions above joints in floor.
 - .7 At pipe chases, pilasters, columns, and changes in wall thickness.
 - .8 At a maximum of 3000 mm (10’-0”) from bonded intersections or corners and preferably one block unit from the corner.
 - .9 At return angles in L, T, and U shaped buildings.
- .2 Provide control joints on one side of large doors or windows less than 1800 mm (6’-0”), and on both sides of openings greater than 1800 mm (6’-0”). At the top of the opening, offset the control joint to the end of the lintels. One end of the lintel at control joints shall be allowed to slide to permit movement. Use plastic or bituminous sheets for a slip plate.
- .3 To form control joints in block walls, the core of the full height vertical joint shall be filled completely with mortar to provide a key. First insert a strip of building paper to keep the mortar from bonding to one side. The first core each side of the joint shall be grouted solid full height and reinforced with 1-15M typical unless indicated otherwise on Drawings.
- .4 Install compressible joint filler and backing rod, and caulk control joint each side using a polyurethane sealant that matches block and mortar colour. Prepare and prime joint in accordance with manufacturer’s recommendations. Joint width shall match mortar joint unless indicated otherwise.

- .5 Bond beam reinforcement shall be continuous at the control joint unless indicated otherwise on Drawings. Provide a raked joint to control the crack location.
- .6 Interior control joints shall be provided where interior non-loadbearing walls meet loadbearing walls and partition walls meet exterior walls.

3.6 LATERAL SUPPORT AND ANCHORAGE

- .1 Lateral support and anchorage in accordance with CSA-S304.1, and as indicated on Drawings and Specifications.
- .2 Non-load bearing walls shall be supported at the top of the wall with 100x100x6x150 mm long (4"x4"x1/4"x6") clip angles each side at a maximum spacing of 10t or 2000 mm (79") o/c, whichever is less, unless indicated otherwise on Drawings.

3.7 CO-OPERATION WITH WORK OF OTHER TRADES

- .1 This Contractor shall co-operate with all other trades on the work leaving all chases, slots and reglets and building in, as the work progresses, of all lintels, loose lintels, bearing plates, inserts, flashing, frames, sleeves, hangers, anchors, bolts, etc. as supplied by others. Grout build in items plumb, level, rigid and secure. Building-in shall be done in accordance with the requirements of Section 04 05 00.
- .2 Provide all openings in masonry walls accurately, and neatly finished, where required or indicated including those required by the Mechanical and Electrical trades. Locations of such openings shall be the responsibility of the trade involved. Co-ordinate with other trades to minimize cutting and patching.
- .3 Doors and openings in interior exposed masonry partitions shall be adjusted to present a uniform appearance with a minimum of unit cuts.
- .4 Chases and openings shall be accurately located and neatly finished to the required sizes.

3.8 CLEANING

- .1 Standard and Decorative block: Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing. Where necessary clean exposed masonry surfaces with an approved cleaning solution and thoroughly rinse with clean water. Avoid staining of masonry. Repeat cleaning of masonry as often as required to produce surfaces to the satisfaction of Departmental Representative or Designate.
- .2 It is essential that all masonry be protected during construction to avoid the need for excessive cleaning and reduce efflorescence after completion.
- .3 Use only fibre bristle brushes for cleaning, wire brushes shall not be used.
- .4 Replace defective mortar to match adjacent work.

- .5 On completion of the work, remove all surplus materials from the site.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A53/A53M-02, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A307-07b, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 - .3 ASTM A325-07a, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.181-99, Ready-Mixed, Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA-G164-M92(C2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA-S16-01, Limit States Design of Steel Structures.
 - .4 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
 - .5 CSA W59-03, Welded Steel Construction (Metal Arc Welding) Metric.
- .4 The Environmental Choice Program
 - .1 CCD-047a-98, Paints, Surface Coatings.
 - .2 CCD-048-98, Surface Coatings - Recycled Water-borne.

1.2 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:
 - .1 For finishes, coatings, primers and paints.
- .2 Shop Drawings
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

- .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.3 QUALITY ASSURANCE

- .1 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
 - .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Storage and Protection:
 - .1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.
 - .2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 MATERIALS

- .1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade 350W.
- .2 Steel pipe: to ASTM A53/A53M standard weight black finish.
- .3 Welding materials: to CSA W59.
- .4 Welding electrodes: to CSA W48 Series.

- .5 Anchor bolts: to CAN/CSA-G40.20/G40.21, Grade 300W or ASTM A307.
- .6 Bolts, nuts and washers: to ASTM A325.
- .7 Grout: non-shrink, non-metallic, flowable, 20 MPa at 3 days and 50 MPa at 28 days.

2.2 FABRICATION

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof flat oval headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

- .1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m² to CAN/CSA-G164.
- .2 Shop coat primer: to CAN/CGSB-1.40.
- .3 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.
- .4 Exterior painting to Section 09 97 19 - Painting Exterior Metal Surfaces.

2.4 ISOLATION COATING

- .1 Isolate aluminum from following components, by means of bituminous paint:
 - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
 - .2 Concrete, mortar and masonry.
 - .3 Wood.

2.5 SHOP PAINTING

- .1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.
- .2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.
- .3 Clean surfaces to be field welded; do not paint.

- .4 Do shop painting after fabrication and before damage to surface occurs from weather or other exposure.
- .5 Do not paint material surfaces which are to be embedded in concrete.
- .6 Do not paint metal within 50mm of edge which is to be welded. Give unprotected steel one coat of boiled linseed oil or other approved protective coating after shop fabrication is completed.

2.6 ANGLE LINTELS

- .1 Steel angles: galvanized, sizes indicated for openings. Provide 150 mm minimum bearing at ends.
- .2 Weld or bolt back-to-back angles to profiles as indicated.

Part 3 Execution

3.1 ERECTION

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Engineer such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Provide components for building by other sections in accordance with shop drawings and schedule.
- .6 Make field connections with bolts to CAN/CSA-S16.1, or weld.
- .7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
 - .2 CSA O121-M1978(R2003), Douglas Fir Plywood.
 - .3 CSA O141-05, Softwood Lumber.
 - .4 CSA O151-04, Canadian Softwood Plywood.
- .2 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 2005.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard and wood based composite panels in accordance with CSA standards.

1.5 DELIVERY, STORAGE, AND HANDLING

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

Part 2 Products

2.1 TIMBER FRAMING AND STRUCTURAL MATERIALS

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
 - .1 CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Framing and board lumber: in accordance with NBC.

- .3 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers:
 - .1 Board sizes: "Standard" or better grade.
 - .2 Dimension sizes: "Standard" light framing or better grade.
 - .3 Post and timbers sizes: "Standard" or better grade.

2.2 PANEL MATERIALS

- .1 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.0.
- .2 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .3 Canadian softwood plywood (CSP): to CSA O151, standard construction.
- .4 Poplar plywood (PP): to CSA O153, standard construction.

2.3 ACCESSORIES

- .1 Nails, spikes and staples: to CSA B111.
- .2 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

2.4 FASTENER FINISHES

- .1 Galvanizing: to CAN/CSA-G164, use galvanized fasteners for exterior and fire-retardant treated lumber.

2.5 WOOD PRESERVATIVE

- .1 SCAQMD Rule #1113 - Architectural Coatings.
- .2 Maximum allowable VOC limit 350g/L.

Part 3 Execution

3.1 PREPARATION

- .1 Store wood products.

3.2 INSTALLATION

- .1 Install members true to line, levels and elevations, square and plumb.
- .2 Construct continuous members from pieces of longest practical length.
- .3 Install spanning members with "crown-edge" up.

- .4 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
- .5 Install furring and blocking as required to space-out and support casework, cabinets, electrical equipment mounting boards, and other work as required.
- .6 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .7 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.
- .8 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

3.3 ERECTION

- .1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .2 Countersink bolts where necessary to provide clearance for other work.

3.4 SCHEDULES

- .1 Electrical equipment mounting boards:
 - .1 Provide electrical equipment backboards for mounting electrical equipment as indicated. Use 19 mm thick plywood on 19 x 38 mm furring around spacing, perimeter and at maximum 300 mm intermediate

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 07 92 10 - Joint Sealing.

1.2 REFERENCES

- .1 Architectural Woodwork Manufacturers Association of Canada (AWMAC)
 - .1 AWMAC Quality Standards for Architectural Woodwork.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- .3 Canadian Standards Association (CSA)
 - .1 CSA B111-74(R1998), Wire Nails, Spikes and Staples.
 - .2 CSA O121-M89(R1998), Douglas Fir Plywood.
- .4 Environmental Choice Program (EPC)
 - .1 ECP-44-92, Adhesives.
- .5 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA LD-3.
- .6 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber, 2000.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate details of construction, profiles, jointing, fastening and other related details.
 - .1 Scales: profiles full size, details 1/2 full size.
- .3 Indicate materials, thicknesses, finishes and hardware.
- .4 Indicate locations of service outlets in millwork, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate samples: sample size 200 x 300 mm long unless specified otherwise of cabinet finishes.

- .3 Submit duplicate colour samples of laminated plastic for colour selection.
- .4 Submit duplicate samples of laminated plastic joints, edging and postformed profiles.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials of this section in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Protect millwork against dampness and damage during and after delivery.
- .3 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.

Part 2 Products

2.1 MATERIALS

- .1 Softwood lumber: unless specified otherwise, S4S, moisture content 19 % or less in accordance with following standards:
 - .1 CAN/CSA-O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 AWMAC custom grade, moisture content as specified.
- .2 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .3 Nails and staples: to CSA B111.
- .4 Wood screws: steel, type and size to suit application.
- .5 Splines: metal.
- .6 Sealant: to suit application and match materials.
- .7 MDF (medium density fibreboard) core: to ANSI A208.2, Grade 130, minimum 19 mm thick, density 769 kg/m².
- .8 Plastic Laminate: Conforming to ANSI/NEMA LD3-2005, Arborite Plus, Nevamar ARP, or other acceptable equivalent by Formica and WilsonArt.
 - .1 Decorative Sheet and Liner Sheet, Regular Grade (GP-R), {1.2 mm}[0.048"] for flat work.
 - .2 Postforming Grade (PF-30), {0.76 mm}[0.030"] for postformed counter tops.
 - .3 Backing Sheet, in same thickness as face sheet.
 - .4 Surface Finish: Suede Finish.
 - .5 Colour: Selected by Consultant [Architect] from manufacturer's standard range.

- .9 Laminated plastic adhesive: urea resin adhesive to CSA O112.5 or contact adhesive to CAN/CGSB-71.20.
 - .1 Test for acceptable VOC emissions in accordance with ASTM D2369 and ASTM D2832.
 - .2 Acceptable materials: ECP-44.
- .10 Solid Surfacing Material: composed of acrylic polymer and alumina trihydrate (ATH), with integral colour and design, stain resistant to chemicals anticipated for use, similar to Dupont Corian, or other product equivalent that is acceptable to Departmental Representative or Designee. Price Group C and D. Colour, textures and patterns to later selection by Departmental Representative or Designee from manufacturer's full product range.

2.2 FABRICATION

- .1 Set nails and countersink screws apply plain wood filler to indentations, sand smooth and leave ready to receive finish.
- .2 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
- .3 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.
- .4 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .5 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .6 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3000 mm. Keep joints 600 mm from sink cutouts.
- .7 Form shaped profiles and bends as indicated, using postforming grade laminate to laminate manufacturer's instructions.
- .8 Apply laminate backing sheet to reverse side of core of plastic laminate work.

2.3 FINISHING

- .1 Plastic laminate finish as indicated on millwork drawings.

Part 3 Execution

3.1 INSTALLATION

- .1 Do architectural woodwork to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.

- .2 Install prefinished millwork at locations shown on drawings. Position accurately, level, plumb straight.
- .3 Fasten and anchor millwork securely. Provide heavy duty fixture attachments for wall mounted cabinets.
- .4 Use draw bolts in countertop joints.
- .5 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.
- .6 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant.
- .7 Apply bituminous coating over wood framing members in contact with masonry or cementitious construction.
- .8 Fit hardware accurately and securely in accordance with manufacturer's written instructions.
- .9 Site apply laminated plastic to units as indicated. Adhere laminated plastic over entire surface. Make corners with hairline joints. Use full sized laminate sheets. Make joints only where indicated. Slightly bevel arises.
- .10 For site application, offset joints in plastic laminate facing from joints in core.

3.2 CLEANING

- .1 Clean millwork and cabinet work, inside cupboards and drawers and outside surfaces.
- .2 Remove excess glue from surfaces.

3.3 PROTECTION

- .1 Protect millwork and cabinet work from damage until final inspection.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for sheet metal roofing.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A653/A653M-[02a], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.3 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate arrangements of sheets and joints, types and locations of fasteners and special shapes and relationship of panels to structural frame or substrate.
- .3 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Submit duplicate 300 x 300 mm samples of each sheet metal material.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Separate for reuse and recycling and place in designated containers Steel or Metal waste in accordance with Waste Management Plan.
- .5 Place materials defined as hazardous or toxic in designated containers.
- .6 Ensure emptied containers are sealed and stored safely.
- .7 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative or Designee.
- .8 Unused paint, caulking, and sealing compound materials must be disposed of at an official hazardous material collections site as approved by Departmental Representative or Designee.

- .9 Unused paint, caulking, and sealing compound materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .10 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 SHEET METAL MATERIALS

- .1 Zinc coated steel sheet: to ASTM A653/A653M, commercial quality, with Z275 coating, prefinish as specified in 2.2, 60 mm minimum base metal thickness.

2.2 PREFINISHED STEEL SHEET

- .1 Prefinished steel with factory applied silicone modified polyester.
 - .1 Class F1S.
 - .2 Colour[selected by Departmental Representative or Designee from manufacturer's standard range.
 - .3 Specular gloss: 30 units +/-5 to ASTM D523.
 - .4 Coating thickness: not less than 25 micrometres.
 - .5 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:
 - .1 Outdoor exposure period 1000 hours.
 - .2 Humidity resistance exposure period 1000 hours.

2.3 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB-37.5.
- .3 Underlay: triple layer, spun bonded polypropylene, water resistant breathable underlayment, similar to SRP Canada Inc. AirOutShield Roof.
- .4 Sealant: compatible with systems materials, recommended by system manufacturer.
- .5 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.
- .6 Fasteners: concealed.
- .7 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .8 Touch-up paint: as recommended by sheet metal roofing manufacturer.

2.4 FABRICATION

- .1 Form individual pieces in 2400 mm maximum lengths. Make allowances for expansion at joints.
- .2 Hem exposed edges on underside 12 mm, mitre and seal.
- .3 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .4 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.
- .5 Protect metals against oxidization by backpainting with isolation coating.

Part 3 Execution

3.1 INSTALLATION

- .1 Use concealed fastenings except where approved by Departmental Representative or Designee before installation.
- .2 Provide underlay under sheet metal roofing. Secure in place and lap joints 100 mm minimum.
- .3 Install sheet metal roof panels using cleats.
- .4 Secure cleats with two fasteners each and cover with cleat tabs.
- .5 Stagger transverse seams in adjacent panels.
- .6 Flash roof penetrations with material matching roof panels, and make watertight.
- .7 Form seams in direction of water-flow and make watertight.

3.2 STANDING SEAM ROOFING

- .1 Use minimum 0.60 mm mm thick prefinished steel sheet , minimum 400 mm wide by minimum 2400 mm long sheets to make roofing with standing seams 400 mm on centre.
- .2 Apply sheet metal roofing beginning at eaves. Loose lock pans to valley flashing and edge strips at eaves and gable rakes.
- .3 Finish standing seams 25 mm high on flat surfaces .
 - .1 Make first fold 6 mm wide single fold and second fold 12 mm wide, providing locked portion of standing seam with 5 plies in thickness.
 - .2 Fold lower ends of seams at eaves over at 45 degrees angle.
 - .3 Terminate standing seams at ridge and hips by turning down in tapered fold.

- .4 Form valleys of sheets not exceeding 3 m in length. Lap joints 150 mm in direction of flow.
 - .1 Extend valley sheet minimum 150 mm under roofing sheets.
 - .2 At valley line, double fold valley and roofing sheets and secure with cleats spaced 450 mm on centre.

3.3 BUILT-IN GUTTERS

- .1 Form built-in box gutter lining with minimum 0.60 mm thick prefinished sheet steel conforming to profile of gutters.
- .2 Use 1000 mm long sheets if section profile of gutter exceeds 1000 mm. Use 2.4 m or 3 m long sheets if sectional profile is less than 1000 mm.
- .3 Longitudinal joints not acceptable.
- .4 Secure gutter lining to substrate with screws, washers and expansion shields spaced maximum 1200 mm on centre along centre of lining.
- .5 At roof edges extend gutter lining under metal roofing 150 mm minimum and terminate in 20 mm folded edge secured by cleats. Hook lower end of roofing into lock strip to form 20 mm wide loose-lock seam.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials, preparation and application for caulking and sealants.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Manufacturer's product to describe.
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Submit duplicate samples of each type of material and colour.
- .5 Cured samples of exposed sealants for each color where required to match adjacent material.
- .6 Submit manufacturer's instructions in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Instructions to include installation instructions for each product used.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

1.6 PROJECT CONDITIONS

- .1 Environmental Limitations:
 - .1 Do not proceed with installation of joint sealants under following conditions:
 - .1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.
 - .2 When joint substrates are wet.
 - .2 Joint-Width Conditions:
 - .1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
 - .3 Joint-Substrate Conditions:
 - .1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.
- .2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

Part 2 Products

2.1 SEALANT MATERIALS

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.
- .3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 **Sealant Type 1:** One Part moisture curing modified urethane sealant: To meet specified requirements of ASTM C920, Type S, Grade NS, Class 25, Use NT, M, A, and O.
- .2 **Sealant Type 2:** Silicone Sealant: One Part sealant mildew resistant. To meet specified requirements of ASTM C920, Type S, Grade NS, Use NT, G, A and O.

- .3 **Sealant Type 3:** not used.
- .4 **Sealant Type 4:** Siliconized Acrylic Latex Sealant to meet specified requirements of ASTM C83.
- .5 **Sealant Type 5:** Multi-component, chemically curing polyurethane, to meet specified requirements of ASTM C920, Type M, Grade P, Class 25, Use T, M, and O.

2.3 SEALANT SCHEDULE

- .1 Perimeters of exterior openings where frames meet exterior facade of building (i.e. block, precast masonry): Sealant type: 1
- .2 Expansion and control joints in exterior surfaces of poured-in-place concrete walls: Sealant type: 1
- .3 Exterior joints in horizontal wearing surfaces (as itemized): Sealant type: 1
- .4 Seal interior perimeters of exterior openings as detailed on drawings: Sealant type: 4
- .5 Control and expansion joints on the interior of exterior surfaces of unit masonry walls: Sealant type: 1
- .6 Interior control and expansion joints in floor surfaces: Sealant type: 5
- .7 Perimeters of interior frames, as detailed and itemized: Sealant type: 4
- .8 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): Sealant type: 1
- .9 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, waterclosets, basins, vanities): Sealant type: 2
- .10 Exposed interior control joints in drywall: Sealant type: 1

2.4 JOINT CLEANER

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.
- .2 Primer: as recommended by manufacturer.

Part 3 Execution

3.1 PROTECTION

- .1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

- .1 Sealant.
 - .1 Apply sealant in accordance with manufacturer's written instructions.
 - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
 - .3 Apply sealant in continuous beads.
 - .4 Apply sealant using gun with proper size nozzle.
 - .5 Use sufficient pressure to fill voids and joints solid.
 - .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
 - .8 Remove excess compound promptly as work progresses and upon completion.

- .2 Curing.
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.
- .3 Cleanup.
 - .1 Clean adjacent surfaces immediately and leave Work neat and clean.
 - .2 Remove excess and droppings, using recommended cleaners as work progresses.
 - .3 Remove masking tape after initial set of sealant.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .3 Section 07 92 10 - Joint Sealing: Caulking of joints between frames and other building components.
- .4 Section 08 71 10 - Door Hardware - General: Supply of finish hardware, including weatherstripping and mounting heights.
- .5 Section 09 91 23 - Interior Painting.
- .6 Section 09 91 13 - Exterior Painting.

1.2 REFERENCES

- .1 Canadian Steel Door Manufacturers' Association, (CSDMA).
 - .1 CSDMA, Specifications for Commercial Steel Doors and Frames.
 - .2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors.

1.3 DESIGN REQUIREMENTS

- .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.
- .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, louvred, arrangement of hardware and finishes.
- .3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors, exposed fastenings, reinforcing, and finishes.
- .4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 MATERIALS

- .1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

2.2 DOOR CORE MATERIALS

- .1 Stiffened: face sheets laminated, uninsulated core.

2.3 ADHESIVES

- .1 Steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
- .2 Lock-seam doors: resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMER

- .1 Touch-up prime CAN/CGSB-1.181.

2.5 PAINT

- .1 Field paint steel doors and frames in accordance with Sections 09 91 23 - Interior Painting, 09 91 13 - Exterior Painting. Protect weatherstrips from paint. Provide final finish shall be free of scratches or other blemishes.

2.6 ACCESSORIES

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Exterior and interior, top and bottom caps: steel.
- .3 Door bottom seal: Metal with neoprene strip.
- .4 Metallic paste filler: to manufacturer's standard.

2.7 FRAMES FABRICATION GENERAL

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Exterior and Interior frames: 1.6 mm welded type construction.
- .4 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .5 Protect mortised cutouts with steel guard boxes.
- .6 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .7 Manufacturer's nameplates on frames and screens are not permitted.
- .8 Conceal fastenings except where exposed fastenings are indicated.
- .9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

2.8 FRAME ANCHORAGE

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.
- .4 Locate anchors for frames in openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm o.c. maximum.

2.9 FRAMES: WELDED TYPE

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.

- .6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 DOOR FABRICATION GENERAL

- .1 Doors: swing type, flush, with provision for louvre openings as indicated.
- .2 Exterior and Interior doors: hollow steel construction.
- .3 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .4 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.
- .5 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .6 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .8 Manufacturer's nameplates on doors are not permitted.

2.11 HOLLOW STEEL CONSTRUCTION

- .1 Form each face sheet for doors from 1.6 mm sheet steel.
- .2 Reinforce doors with vertical stiffeners, securely welded or laminated to each face sheet at 150 mm on centre maximum.

Part 3 Execution

3.1 INSTALLATION GENERAL

- .1 Install doors and frames to CSDMA Installation Guide.

3.2 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support

at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material.

3.3 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 10 - Door Hardware - General.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latchside and head: 1.5 mm.
 - .3 Finished floor, non-combustible sill and thresholds: 13 mm.
- .3 Adjust operable parts for correct function.
- .4 Install louvres.

3.4 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Section 01 61 00 - Common Product Requirements.
- .3 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

- .1 Canadian Steel Door Manufacturers' Association (CSDMA).
 - .1 CSDMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-69.17-M86(R1993), Bored and Preassembled Locks and Latches.
 - .2 CAN/CGSB-69.18-M90/ANSI/BHMA A156.1-1981, Butts and Hinges.
 - .3 CAN/CGSB-69.19-93/ANSI/BHMA A156.3-1984, Exit Devices.
 - .4 CAN/CGSB-69.20-M90/ANSI/BHMA A156.4-1986, Door Controls (Closers).
 - .5 CAN/CGSB-69.21-M90/ANSI/BHMA A156.5-1984, Auxiliary Locks and Associated Products.
 - .6 CAN/CGSB-69.22-M90/ANSI/BHMA A156.6-1986, Architectural Door Trim.
 - .7 CAN/CGSB-69.24-M90/ANSI/BHMA A156.8-1982, Door Controls - Overhead Holders.
 - .8 CAN/CGSB-69.26-96/ANSI/BHMA A156.10-1991, Power-operated Pedestrian Doors.
 - .9 CAN/CGSB-69.28-M90/ANSI/BHMA A156.12-1986, Interconnected Locks and Latches.
 - .10 CAN/CGSB-69.29-93/ANSI/BHMA A156.13-1987, Mortise Locks and Latches.
 - .11 CAN/CGSB-69.31-M89/ANSI/BHMA A156.15-1981, Closer/Holder Release Device.
 - .12 CAN/CGSB-69.32-M90/ANSI/BHMA A156.16-1981, Auxiliary Hardware.
 - .13 CAN/CGSB-69.34-93/ANSI/BHMA A156.18-1987, Materials and Finishes.
 - .14 CAN/CGSB-69.35-M89/ANSI/BHMA A156.19-1984, Power Assist and Low Energy Power Operated Doors.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications, and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

- .2 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
 - .3 After approval samples will be returned for incorporation in the Work.
- .3 Hardware List:
 - .1 Submit contract hardware list in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .5 Closeout Submittals
 - .1 Provide operation and maintenance data for door closers, locksets, door holders electrified hardware and fire exit hardware for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .3 Pre-installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
 - .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .2 Storage and Protection:
 - .1 Store finishing hardware in locked, clean and dry area.

1.6 WASTE DISPOSAL AND MANAGEMENT

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.7 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Supply two sets of wrenches for door closers, locksets and fire exit hardware.

Part 2 Products

2.1 HARDWARE ITEMS

- .1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

- .1 Locks and latches:
 - .1 Bored and preassembled locks and latches: to CAN/CGSB-69.17, designed for function and keyed as stated in Hardware Schedule.
 - .2 Mortise locks and latches: to CAN/CGSB-69.29, series 1000 mortise lock, heavy duty L series and standard duty commercial AL series, designed for function and keyed as stated in Hardware Schedule.
 - .3 Lever handles: Heavy duty L series 07, Standard duty commercial Jupiter type. Finish 626 dull chromium.
 - .4 Normal strikes: box type, lip projection not beyond jamb.
 - .5 Cylinders: key into keying system.
 - .6 Finished to 626 dull chromium.
- .2 Butts and hinges:
 - .1 Butts and hinges: to CAN/CGSB-69.18.
 - .2 Full mortise type bearing hinges: Three knuckle standard or heavy duty series. All shop area doors to be heavy duty. All office area doors to be standard duty.
 - .3 Size 114 x 101 typical.
 - .4 Exterior door hinges brass or bronze base polished and plated.
 - .5 Interior door hinges steel base polished and plated.
 - .6 Provide non-removable pins at all exterior doors.
 - .7 Finish: 26D, dull chromium.
- .3 Door Closers and Accessories:
 - .1 Door controls (closers): to CAN/CGSB-69.20. Heavy duty parallel and double arm for high traffic application.
 - .2 Finish: powder coat 689 Aluminum.
 - .3 Door controls - overhead holders: to CAN/CGSB-69.24.

- .4 Closer/holder release devices: to CAN/CGSB-69.31.
- .5 Door co-ordinator: concealed for pairs of doors with overlapping astragal.
- .4 Door Operators:
 - .1 Power-operated pedestrian doors: to CAN/CGSB-69.26.
 - .2 Power assist and low energy power operated doors: to CAN/CGSB-69.35.
- .5 Auxiliary locks and associated products: to CAN/CGSB-69.21.
 - .1 Dead bolt. Key into keying system.
 - .2 Cylinders: for installation in deadlocks provided with special doors as listed in Hardware Schedule. Key into keying system.
- .6 Architectural door trim: to CAN/CGSB-69.22.
 - .1 Door protection plates: kick plate type, 1.27 mm thick stainless steel, x 300mm high x width to suit door size. Finish to brushed stainless steel or 26D, dull chromium.
 - .2 Push plates: 1.27 mm thick stainless steel. Size 100 mm x 400 mm. Finish to brushed stainless steel or 26D, dull chromium.
 - .3 Push/Pull units: aluminum or stainless steel to suit door material, 300 mm high, finished to 26D, dull chromium.
- .7 Auxiliary hardware: to CAN/CGSB-69.32.
 - .1 Wall Stop: cast brass or stainless steel, finish 26D dull chromium, GSH 250B.
 - .2 Floor Stop: dome type, cast brass, bronze, finish 26D dull chromium, GSH 218B.
- .8 Door bottom seal: heavy duty, door seal of extruded aluminum frame and solid closed cell neoprene seal, surface mounted, closed ends, adjustable, automatic retract mechanism when door is open, clear anodized finish.
- .9 Thresholds: full width of door opening, stainless steel, smooth top, 127mm wide x 12.7mm high. Finish 32D, dull stainless steel. DS510SS.
- .10 Weatherstripping:
 - .1 Head and jamb seal:
 - .1 Extruded aluminum frame, clear anodized finish and 6.4mm x 12.8mm sponge neoprene. Overall dimension 6.4mm x 25.4mm. DS130C.
 - .2 Adhesive backed neoprene material.
 - .2 Door bottom seal:
 - .1 Extruded aluminum frame, clear anodized finish, 6.4mm x 25mm and rubber sweep, 3.2mm x 51mm. Overall height 63.5mm, DS136C.

2.3 MISCELLANEOUS HARDWARE

- .1 Indexed key control system: to CAN/CGSB-69.21.

2.4 FASTENINGS

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.
- .4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .5 Use fasteners compatible with material through which they pass.

2.5 KEYING

- .1 Doors to be master keyed as noted in Hardware Schedule. Prepare detailed keying schedule in conjunction with Departmental Representative or Designate.
- .2 Provide keys in duplicate for every lock in this Contract.
- .3 Provide three masterkeys for each keying system group.
- .4 Stamp keying code numbers on keys and cylinders.
- .5 Provide construction cores.
- .6 Provide all permanent cores and keys to Departmental Representative or Designate.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Furnish manufacturers' instructions for proper installation of each hardware component.

3.2 INSTALLATION

- .1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door Manufacturers' Association.

- .2 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .3 Install key control cabinet.
- .4 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .5 Remove construction cores when directed by Engineer; install permanent cores and check operation of locks.

3.3 ADJUSTING

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to provide tight fit at contact points with frames.

3.4 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacture's instructions.
- .3 Remove protective material from hardware items where present.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.5 DEMONSTRATION

- .1 Keying System Setup and Cabinet:
 - .1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.
 - .2 Place file keys and duplicate keys in key cabinet on their respective hooks.
 - .3 Lock key cabinet and turn over key to Engineer.
- .2 Maintenance Staff Briefing:
 - .1 Brief maintenance staff regarding:
 - .1 Proper care, cleaning, and general maintenance of projects complete hardware.
 - .2 Description, use, handling, and storage of keys.

- .3 Use, application and storage of wrenches for door closers, locksets and fire exit hardware.
- .3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.6 SCHEDULE

- .1 Hardware Group 1 (Insulated Exterior Metal Door):
 - .1 1-1/2 pr butt hinges HW, 114 x 101 mm NRP 26D.
 - .2 1 exit device, mortise latch type 9875, 626.
 - .3 1 cylinder.
 - .4 1 latch guard.
 - .5 1 electric strike.
 - .6 1 kickplate.
 - .7 1 door closer with hold open.
 - .8 1 threshold.
 - .9 1 door sweep.
 - .10 1 weatherstrip.
- .2 Hardware Group 2 (Insulated Exterior Metal Exit Double Doors):
 - .1 3 pr butt hinges SW, 114 x 101 mm NRP 26D.
 - .2 1 exit device, mortise latch type 9875, 626.
 - .3 1 cylinder.
 - .4 1 latch guard.
 - .5 1 electric strike.
 - .6 2 door closer.
 - .7 1 threshold.
 - .8 2 door sweep.
 - .9 2 weatherstrip.
- .3 Hardware Group 3 (Interior Metal Door):
 - .1 1-1/2 pr butt hinges HW, 114 x 101 mm 26D.
 - .2 1 lock set or latchset.
 - .3 1 cylinder.
 - .4 1 door closer.
 - .5 1 wall stop or floor stop.
 - .6 1 kickplate.

- .4 Hardware Group 4 (Interior Metal Universal Washroom Door):
 - .1 1-1/2 pr butt hinges HW, 114 x 101 mm 26D.
 - .2 1 Lockset with push button on room side.
 - .3 1 Wall stop.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .3 Section 01 45 00 - Quality Control.
- .4 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
 - .2 CAN/CGSB-12.2-M91, Flat, Clear Sheet Glass.
 - .3 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
 - .4 CAN/CGSB-12.4-M91, Heat Absorbing Glass.
 - .5 CAN/CGSB-12.8-97, Insulating Glass Units.
- .2 Flat Glass Manufacturers Association (FGMA).
 - .1 FGMA Glazing Manual .
- .3 Laminators Safety Glass Association (LSGA).
 - .1 LSGA Laminated Glass Design Guide.

1.3 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follow:
 - .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
 - .2 Limit glass deflection to 1/200 with full recovery of glazing materials.

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

- .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit duplicate 300 x 300 mm size samples of tinted glass.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .5 Closeout Submittals:
 - .1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
 - .1 Provide testing and analysis of glass under provisions of Section 01 45 00 - Quality Control.
 - .2 Provide shop inspection and testing for glass.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 SITE CONDITIONS

- .1 Environmental Requirements:
 - .1 Install glazing when ambient temperature is 10degrees C minimum. Maintain ventilated environment for 24 hours after application.
 - .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

Part 2 Products

2.1 MATERIALS: FLAT GLASS

- .1 Float glass: to CAN/CGSB-12.3, Glazing quality, 6.4 mm thick.
- .2 Safety glass: to CAN/CGSB-12.1, transparent, minimum 6.4 mm thick.
 - .1 Type 2-tempered.
 - .2 Class B-float.
 - .3 Category 11 – 540J impact resistance.

- .4 Edge treatment: polished
- .3 Heat absorbing glass: to CAN/CGSB-12.4, 6.25 mm thick.
 - .1 Type 2-Insulating glass unit.
 - .2 Class A-Annealed.
 - .3 Style 1a-Intermediate light transmittance.
 - .4 Grade B-Medium shading co-efficient.
 - .5 Tint colour TBD.
- .4 Low emissivity (LOW E) .
 - .1 Metallic coating: soft, sputtered.
 - .2 Light transmittance: 40%.
 - .3 Shading co-efficient: 0.37.
 - .4 U-Value: 0.33.

2.2 MATERIALS: SEALED INSULATING GLASS

- .1 Insulating glass units: to CAN/CGSB-12.8, double unit, 25 mm overall thickness.
 - .1 Glass thickness: minimum 6.25 mm each light.
 - .2 Inter-cavity space thickness: 12.5 mm between inner and middle lights with low conductivity spacers.
 - .3 Glass coating: surface number 2, low "E" with b tint colour.

2.3 ACCESSORIES

- .1 Setting blocks: EPDM, 80-90 Shore A durometer hardness to ASTM D2240 to suit glazing method, glass light weight and area.
- .2 Spacer shims: Silicone, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.
- .3 Glazing tape:
 - .1 Preformed butyl compound with integral resilient tube spacing device, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; black colour.
 - .2 Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume 2%, designed for compression of 25%, to effect an air and vapour seal.

Part 3 SPEC NOTE: Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 EXAMINATION

- .1 Verify that openings for glazing are correctly sized and within tolerance.
- .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.3 PREPARATION

- .1 Clean contact surfaces with solvent and wipe dry.
- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.

3.4 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Remove traces of primer, caulking.
- .3 Remove glazing materials from finish surfaces.
- .4 Remove labels after work is complete.
- .5 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacture's instructions.
- .6 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.5 PROTECTION OF FINISHED WORK

- .1 After installation, mark light with an "X" by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 The Aluminum Association Inc. (AAI)
 - .1 AAI DAF-45, Designation System for Aluminum Finishes - 9th Edition.
- .2 Air Movement and Control Association International (AMCA)
 - .1 AMCA 501, Application Manual for Air Louvers.
- .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .2 ASTM B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
 - .2 Indicate fabrication and erection details, including anchorage, accessories, and finishes.
- .4 Samples:
 - .1 Where colour is not indicated, submit manufacturer's standard colours to Departmental Representative or Designate for selection.
- .5 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

- .2 Deliver materials to the site in undamaged condition.
- .2 Storage and Protection:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Protect louvres from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Weather resistant louvres, with bird screens made to withstand a wind load of not less than 1.44 kilopascals.
- .2 Ratings to indicate water penetration of 0.06 kilograms or less per square meter of free area at free velocity of 244 meters per minute.
- .3 Aluminum sheet: to ASTM B209 with temper as required for forming plain utility sheet. Finished with 70% PVdF resin based coating to AAMA 2605, colour to later selection by Departmental Representative or Designate.
- .4 Aluminum extrusions: to ASTM B221 alloy 6063-T5. Finished with 70% PVdF resin based coating to AAMA 2605, colour to later selection by Departmental Representative or Designate.
- .5 Screens:
 - .1 Birdscreens: crimped aluminum wire cloth secured to 2 mm thick extruded aluminum frame mitered at corners and secured with corner locks.
 - .2 Shop applied paint coating to match colour of siding.
- .6 Extruded aluminum louvres:
 - .1 Construct louvres from aluminum extrusions of minimum 3 mm thickness to sizes and shapes indicated.
 - .2 Arrange blades, mullions and frame extrusions as indicated.
 - .3 Install concealed vertical stiffeners spaced to meet required loads.
 - .4 Complete louvre assembly to have minimum 50 % free area.
 - .5 Shop applied paint coating to match colour of siding. Custom colour beyond manufacturer's standard range may be required.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install louvres where indicated.
- .2 Set adjustable louvre blades for uniform alignment in open and closed positions.
- .3 Attach bird screen to inside face of louvre or vent.
- .4 Repair damage to louvres to match original finish.
- .5 Install wall louvers using strap anchors or jamb fasteners as appropriate for wall construction and in accordance with manufacturer's recommendations.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.4 PROTECTION

- .1 Where aluminum contacts metal other than zinc, paint dissimilar metal with primer and two coats of aluminum paint.
- .2 Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal
- .3 Section 01 78 00 - Closeout Submittals
- .4 Section 07 92 10 - Joint Sealing

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)
 - .1 CTI A118.4, Specification for Latex Cement Mortar (included in ANSI A108.1).
 - .2 CTI A118.6, Specification for Ceramic Tile Grouts (included in ANSI A108.1).
- .2 Terrazzo Tile and Marble Association of Canada (TTMAC)
 - .1 Tile Specification Guide 09 30 00 2016/2017, Tile Installation Manual.
 - .2 Tile Maintenance Guide 2000.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Include manufacturer's information on:
 - .1 Ceramic tile, marked to show each type, size, and shape required.
 - .2 Mortar and grout.
 - .3 Divider strip.
 - .4 Crack isolation membrane.
- .3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Base tile: submit duplicate, 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.
 - .2 Floor tile: submit duplicate, 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.
 - .3 Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, colour, and size.

1.4 QUALITY ASSURANCE

- .1 Quality Assurance Submittals:
 - .1 Manufacturer's Instructions: manufacturer's installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 AMBIENT CONDITIONS

- .1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 degrees C for 48 hours before, during, and 48 hours after, installation.
- .2 Do not install tiles at temperatures less than 12 degrees C or above 38 degrees C.
- .3 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.

1.7 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Provide minimum 2% of each type and colour of tile required for project for maintenance use. Store where directed.
 - .3 Maintenance material same production run as installed material.

Part 2 Products

2.1 FLOOR AND WALL TILE

- .1 Porcelain tile: to ISO 10545, 300 X 600 mm size, slip resistant surface. Matte finish porcelain, colour-through-body with anti-stain finish. Acceptable manufacturers: Olympia Tile, Centura Tile or Dal-tile. Colour: to later selection.

2.2 BASE TILE

- .1 Base: coved; type, size, colour and texture to match adjacent flooring material.

2.3 TRIM SHAPES

- .1 Conform to applicable requirements of adjoining floor and wall tile.
- .2 Use slip resistant trim shapes for horizontal surfaces of showers, overflow ledges, recessed steps, shower curbs, drying area curbs, and stools.

- .3 Use trim shapes sizes conforming to size of adjoining field wall tile, including existing spaces, unless specified otherwise.
- .4 Internal and External Corners: provide trim shapes as follows where indicated.
 - .1 Bullnose shapes for external corners including edges.
 - .2 Coved shapes for internal corners.
 - .3 Special shapes for:
 - .1 Base to floor internal corners to provide integral coved vertical and horizontal joint.
 - .2 Base to floor external corners to provide bullnose vertical edge with integral coved horizontal joint. Use as stop at bottom of openings having bullnose return to wall.
 - .3 Wall top edge internal corners to provide integral coved vertical joint with bullnose top edge.
 - .4 Wall top edge external corners to provide bullnose vertical and horizontal joint edge.

2.4 MORTAR AND ADHESIVE MATERIALS

- .1 **General:** Adhesives shall be factory blended conforming to ANSI A118.4 and ISO 13007 classifications as indicated. Design shall be based on the tiles specified below.
- .2 Leveling Underlayment and Ramping Mortar:
 - .1 Rapid set pre-tile smoothing and ramping mortar, similar to Ardex AM 100, application thickness of 6 mm to 32 mm to suit project conditions and substrate tolerances.
 - .2 Fast setting, premixed cement based screed mortar for concrete repairs and subfloor preparation work; similar to Mapei Mapecem Premix.
- .3 Primer: Low VOC, low viscosity primer to suit substrates and site conditions as recommended by setting system manufacturer. Provide proof of bonding ability of setting materials where manufacturer recommends that primer is not required for installation.
- .4 **Mortar Bed (Medium):** Pre-blended mix of selected raw materials, portland cement, and graded aggregates with latex mortar admix; conform to ANSI A118.4. and ISO 13007 C2, S1. White where indicated.
- .5 **Medium Bed Highly Flexible Mortar:** Mortar, factory blended select raw materials, portland cement, and graded aggregates, with latex mortar additive, conform to ANSI A118.4. and ISO 13007 C2E, S2. White where indicated.
- .6 **Mortar:** Thin Set Mortar, factory blended select raw materials, portland cement, and graded aggregates, with latex mortar additive, conform to ANSI A118.4 and ISO 13007 C1, S2.
- .7 **Crack Isolation Membrane:** consisting of cold-applied, self-curing, liquid rubber polymer and an integral reinforcing fabric.

- .8 **Epoxy bond coat:** non-toxic, non-flammable, non-hazardous during storage, mixing, application, and when cured.
- .9 **Grout:** Premixed, dry-set, portland cement grout with 100% high performance universal acrylic latex additive, to later colour selection by Departmental Representative. Sanded for floors and unsanded for walls.

2.5 ACCESSORIES

- .1 Metal Tile Trims: including termination strips, wall corners, edge profiles, movement and control joint profiles, stainless steel type,
- .2 Transition Strips: purpose made metal extrusion; stainless steel type.
- .3 Reducer Strips: purpose made metal extrusion; stainless steel type; maximum slope of 1:2.
- .4 Sealant: in accordance with Section 07 92 10 - Joint Sealants.
 - .1 Sealants: maximum VOC limit 250g/L to SCAQMD Rule 1168.

2.6 MIXES

- .1 Mix bond and levelling coats, and grout to manufacturer's instructions.
- .2 Adjust water volumes to suit water content of sand.

2.7 CLEANING COMPOUNDS

- .1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- .2 Materials containing acid or caustic material are not acceptable.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 WORKMANSHIP

- .1 Do tile work in accordance with TTMAC Tile Installation Manual 2016/2017, "Ceramic Tile", except where specified otherwise.
- .2 Apply tile or backing coats to clean and sound surfaces.

- .3 Fit tile around corners, fittings, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.
- .4 Maximum surface tolerance 1:800.
- .5 Make joints between tile uniform and approximately 1.5 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.
- .6 Lay out tiles so perimeter tiles are minimum 1/2 size.
- .7 Sound tiles after setting and replace hollow-sounding units to obtain full bond.
- .8 Make internal angles square, external angles rounded.
- .9 Use termination strips at termination of wall tile panels, except where panel abuts projecting surface or differing plane.
- .10 Install transition strips at junction of tile flooring and dissimilar materials.
- .11 Allow minimum 24 hours after installation of tiles, before grouting.
- .12 Clean installed tile surfaces after installation and grouting cured.

3.3 **Installation Methods:**

- .1 The following installation methods refer to Terrazzo, Tile and Marble Association of Canada's Specification Guide 09 30 00/Tile Installation Manual 2016-2017.
- .2 Install wall tile on masonry and concrete surfaces by method specified in Detail No. 303W-2016-2017, system with use of full strength latex modified adhesive and grout.
- .3 Install wall tile on masonry and concrete surfaces with levelling coat at plumbing fixture trim locations by method specified in Detail No. 303W-2016-2017, system with use of full strength latex modified adhesive and grout.
- .4 Install floor tile in other areas by method specified in Detail No. 311F-2016-2017, with thin-set mortar and dry-set latex modified grout.
- .5 Install large format floor tile by method specified in Detail No. 329 LFT-2016-2017, with crack isolation membrane, medium mortar bed and polymer modified sanded grout.
- .6 Grout tile joints in accordance with grout manufacturer's directions and to fill joints solidly.
- .7 Caulk around all pipes and openings made in ceramic tile, with Sealant Type 5, applied in accordance with Section 07 92 00.

3.4 Control Joints:

- .1 Provide control joints in porcelain tile and ceramic tile floors at maximum 5 m oc in both directions except areas exposed to moisture and direct sunlight, control joint spacing shall be maximum 3.6 m. Also locate control joints in tile floors over control joints in concrete substrate.
- .2 Rake out joint full depth including bedding to substrate. Provide sealant backing or if depth doesn't allow provide bond breaker tape beneath sealant.
- .3 Sealant depth shall be at least as deep as joint is wide, but no deeper than 12 mm. Caulk control joints with Sealant Type 5, applied in accordance with Section 07 92 10.

3.5 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 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.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal
- .3 Section 03 30 00 – Cast –in-Place Concrete
- .4 Section 03 35 00 – Concrete Finishing

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.186-1996, High Performance Glazed Coating System, Interior.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, cleaning procedures.
- .3 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit WHMIS MSDS - Material Safety Data Sheets. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for epoxy coatings. Indicate VOC content.
- .4 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit duplicate 400 x 200 mm samples of each colour and finish and decorative effects, coating applied to smooth hardboard.
- .5 Closeout Submittals:
 - .1 Provide maintenance data for coatings for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Single Source Responsibility: Obtain primary resinous flooring materials including primers, resins, hardening agents, finish or sealing coats from a single manufacturer. Contractor shall have completed at least five projects of similar size and complexity.
- .2 Pre-Installation Conference

- .1 General contractor shall arrange a meeting not less than thirty days prior to starting work.
- .2 Attendance:
 - .1 General Contractor
 - .2 DCC Representative
 - .3 Manufacturer/Installer's Representative
- .3 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
- .4 Apply coating of each finish to 9 m² area of surface to be treated.
- .5 Allow 24 hours for inspection of mock-up by DCC Representative before proceeding with coating work.
- .6 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

1.5 DELIVERY, HANDLING AND STORAGE

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
 - .1 Deliver and store materials in manner to prevent damage.
 - .2 Ensure materials remain in original wrapping and containers until used.
- .2 All materials must be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.
- .3 Store material in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained between 16° and 32°C.
- .4 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 SITE CONDITIONS

- .1 Safety:
 - .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of materials.
 - .2 Ensure no open flame heating devices are used.
 - .3 Discourage occupancy of treated space until volatile materials are no longer being emitted and there is no odour.
 - .4 Provide adequate respiratory protection to exposed individuals.
- .2 Ventilation:

- .1 Provide ventilation continuously during and after coating application. Run system 24 hours per day during application; provide continuous ventilation for 7 days after completion of application.
- .3 Temperature:
 - .1 Do not apply epoxy systems unless uniform minimum 18 degrees C air temperature at installation area for 7 days prior to and 48 hours after application.
- .4 Concrete Substrate:
 - .1 Concrete surfaces must be properly cured for a minimum of 30 days. A vapour barrier must be present for concrete sub-floors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the epoxy flooring.
- .5 Manufacturer's representative must be on job site at start of installation.

Part 2 Products

2.1 MATERIALS

- .1 Floors and Concrete Upstands:
 - .1 Epoxy Polyamide Floor Primer: A two-component, solvent based, epoxy polyamide coating.
 - .2 Epoxy Floor Coating 100% solids, 0 VOC, two-component general service epoxy coating. Surface texture with selected, graded aggregate.
 - .3 Polyurethane Floor Sealer: Solvented polyaspartic polyurethane resistant to staining of Skydrol.
- .2 Joint Sealant Materials:
 - .1 Type produced by manufacturer of resinous flooring system for type of service and joint condition indicated.
- .3 Base:
 - .1 150mm (4") as indicated on finish schedule
 - .2 Metal Edge Cap Strips: extruded aluminum, smooth, mill finish with lip to extend under coved floor finish and profile to cover top of coved epoxy flooring and underside of wall tile finish.
 - .3 Cove Support Strip: pre-fabricated formed aluminum reinforcing, 38mm x 38mm, manufactured by FlashCove Prefabricated Bases Inc. or acceptable alternative.
- .4 Filler: for filling of isolated surface imperfections including cracks, as recommended by flooring manufacturer
- .5 Underlayment: for levelling slab areas, as recommended by flooring manufacturer

2.2 MIXES

- .1 Mix and prepare coatings according to manufacturer's instructions.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

- .1 Prepare surfaces in accordance with CAN/CGSB-1.186 and coating material manufacturer's instructions.
- .2 Prepare concrete by mechanical means by using a shot blast machine for removal of bond inhibiting materials such as curing compounds or laitance.
- .3 Mask surrounding surfaces to provide neat, clean juncture lines.
- .4 Protect adjacent surfaces and equipment from damage by overspray.

3.3 APPLICATION

- .1 Primer: Apply with airless sprayer, brush on roller or roller (medium nap) to an actual dry film thickness of 50 - 70 microns (2 - 3 mil). Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates. Coordinate timing of primer application with application of troweled mortar to ensure optimum adhesion between resinous flooring materials and substrate.
- .2 Troweled Mortar: Mix mortar material according to manufacturer's recommended procedures. Uniformly spread mortar over substrate using manufacturer's specially designed screed box adjusted to manufacturer's recommended height. Hand trowel apply mixed material over freshly primed substrate using stainless steel finishing trowels.
- .3 Coating: Mix coating according to manufacturer's recommended procedures. Squeegee apply and backroll. (4 - 5 mil).
- .4 Coating/Texture: Remove any surface imperfections by lightly abrading and vacuuming the floor surface. Mix coating and texture according to manufacturer's recommended procedures. Squeegee apply and backroll textured coating with strict adherence to manufacturer's installation procedures and coverage rates.
- .5 Polyurethane Sealer: Mix coating according to manufacturer's recommended procedures. Roll apply to 2 to 5 mils wet film thickness.
- .6 Joint Sealant: Install manufacturer's epoxy or urethane sealant compatible with floor finish.

- .7 Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic wearing surface of thickness indicated, uninterrupted except at divider strips, sawn joints or other types of joints (if any), indicated or required.
- .8 Provide smooth transitions at all floor, wall and ceiling junctures.

3.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 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.
- .2 Material Testing:
 - .1 The right is reserved to invoke the following material testing procedure at any time, and any number of times during period of flooring application.
 - .2 The DCC Representative will engage service of an independent testing laboratory to sample materials being used on the jobsite. Samples of material will be taken, identified and sealed, and certified in presence of Contractor.
 - .3 Testing laboratory will perform tests for any of characteristics specified, using applicable testing procedures referenced herein, or if none referenced, in manufacturer's product data.
 - .4 If test results show materials being used do not comply with specified requirements, Contractor may be directed by DCC Representative to stop work; remove non-complying materials; pay for testing; reapply flooring materials to properly prepared surfaces which had previously been coated with unacceptable materials.

3.5 CURING, PROTECTION AND CLEANING

- .1 Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.
- .2 Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

3.6 CLEANING

- .1 Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .3 Section 01 45 00 - Quality Control.
- .4 Section 01 61 00 - Common Product Requirements.
- .5 Section 01 78 00 - Closeout Submittals.
- .6 Section 09 91 23 - Painting of Interior Surfaces.

1.2 REFERENCES

- .1 Architectural Painting Specifications Manual, Master Painters Institute (MPI).
- .2 Systems and Specifications Manual, SSPC Painting Manual, Volume Two, Society for Protective Coatings (SSPC).

1.3 QUALITY ASSURANCE

- .1 When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .3 Conform to latest MPI requirements for exterior painting work including preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- .5 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.
- .6 Standard of Acceptance:
 - .1 Walls, Doors and Frames, Miscellaneous Metal Fabrications: No defects visible from a distance of 1000 mm at 90⁰ to surface.

- .2 Soffits: No defects visible from floor at 45⁰ to surface when viewed using final lighting source.
- .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.4 SUBMITTALS

- .1 Submit product data and manufacturer's installation/application instructions for paints and coating products to be used in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Upon completion, submit records of products used. List products in relation to finish system and include the following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.
 - .4 MPI Environmentally Friendly classification system rating.
 - .5 Manufacturer's Material Safety Data Sheets (MSDS).

1.5 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted on the following substrate materials:
 - .1 3 mm plate steel for finishes over metal surfaces.
- .3 When approved, samples shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.
- .4 Submit full range of available colours where colour availability is restricted.

1.6 QUALITY CONTROL

- .1 Provide mock-up in accordance with Section 01 45 00 - Quality Control.
- .2 When requested by the Departmental Representative or Designate, prepare and paint designated surface, area, room or item (in each colour scheme) to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.7 EXTRA MATERIALS

- .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

- .2 Submit one - four litre can of each type and colour of primer and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

1.8 DELIVERY, HANDLING AND STORAGE

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver and store materials in original containers, sealed, with labels intact.
- .3 Labels shall clearly indicate:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
- .4 Remove damaged, opened and rejected materials from site.
- .5 Provide and maintain dry, temperature controlled, secure storage.
- .6 Observe manufacturer's recommendations for storage and handling.
- .7 Store materials and supplies away from heat generating devices.
- .8 Store materials and equipment in a well ventilated area with temperature range 7⁰C to 30⁰C.
- .9 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .10 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.
- .11 Remove paint materials from storage only in quantities required for same day use.
- .12 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

1.9 SITE REQUIREMENTS

- .1 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, perform no painting work when:
 - .1 Ambient air and substrate temperatures are below 10 ⁰C.
 - .2 Substrate temperature is over 32 ⁰C unless paint is specifically formulated for application at high temperatures.

- .3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
 - .4 The relative humidity is above 85% or when dew point is less than 3 °C variance between air/surface temperature.
 - .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
- .2 Surface and Environmental Conditions:
- .1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
 - .3 Apply paint only when previous coat of paint is dry or adequately cured.
 - .4 Apply paint finishes only when conditions forecast for entire period of application fall within manufacturer's recommendations.
 - .5 Do not apply paint when:
 - .1 Temperature is expected to drop below 10 °C before paint has thoroughly cured.
 - .2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.
 - .3 Surface to be painted is wet, damp or frosted.
 - .6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.
 - .7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.
 - .8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

1.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .3 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .4 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

- .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
- .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
- .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
- .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .5 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- .6 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

Part 2 Products

2.1 MATERIALS

- .1 Paint materials listed in the latest edition of the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Paint materials for paint systems shall be products of a single manufacturer.
- .3 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall:
 - .1 be water soluble.
 - .2 be non-flammable.
 - .3 be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
 - .4 be manufactured without compounds which contribute to smog in the lower atmosphere.
 - .5 do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
- .4 Water-borne surface coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising there from, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).
- .5 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .6 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.0°C or greater.

- .7 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
 - .1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
 - .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
- .8 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.
- .9 Recycled water-borne surface coatings must contain 50 % post-consumer material by volume.
- .10 Recycled water-borne surface coatings must not contain:
 - .1 Lead in excess of 600.0 ppm weight/weight total solids.
 - .2 Mercury in excess of 50.0 ppm weight/weight total product.
 - .3 Cadmium in excess of 1.0 ppm weight/weight total product.
 - .4 Hexavalent chromium in excess of 3.0 ppm weight/weight total product.
 - .5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.
- .11 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.
 - .1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.
 - .2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.
 - .3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

2.2 COLOURS

- .1 Departmental Representative or Designate will provide Colour Schedule after Contract award.
- .2 Colour schedule will be based upon selection of five base colours and three accent colours. No more than eight colours will be selected for the entire project and no more than three colours will be selected in each area.
- .3 Selection of colours will be from manufacturer's full range of colours.
- .4 Where specific products are available in a restricted range of colours, selection will be based on the limited range.

- .5 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site.
- .2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.
- .3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.
- .4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

- .1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level Category/	Units @ 60E/	Units @ 60E/
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

- .2 Gloss level ratings of painted surfaces shall be as specified herein and as noted on Finish Schedule.

2.5 EXTERIOR PAINTING SYSTEMS

- .1 Asphalt Surfaces: zone/traffic marking for drive and parking areas, etc.
 - .1 EXT 2.1B Alkyd zone/traffic marking finish.
- .2 Metal Fabrications:
 - .1 EXT 5.1D - Alkyd G5 finish.
 - .2 EXT 5.1G - Pigmented polyurethane finish (over epoxy zinc rich primer)
- .3 Galvanized Metal: not chromate passivated
 - .1 EXT 5.1D - Alkyd G5 finish.

Part 3 Execution

3.1 GENERAL

- .1 Perform preparation and operations for exterior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 EXISTING CONDITIONS

- .1 Investigate substrates for problems related to proper and complete preparation of surfaces to be painted.
- .2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.3 PROTECTION

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 Protect passing pedestrians, building occupants and general public in and about the building.
- .5 Removal of light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking painting operations by General Contractor. Items shall be securely stored and re-installed after painting is completed by General Contractor.
- .6 Move and cover exterior furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .7 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas to approval of Departmental Representative or Designate.

3.4 CLEANING AND PREPARATION

- .1 Clean and prepare exterior surfaces in accordance with MPI Painting Specification Manual requirements. Refer to the MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and other surface debris by brushing, wiping with dry, clean cloths or compressed air.

- .2 Wash surfaces with a biodegradable detergent (and bleach where applicable) and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
 - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
 - .6 Use trigger operated spray nozzles for water hoses.
 - .7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.
-
- .2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
 - .3 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
 - .4 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning.
 - .5 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

3.5 APPLICATION

- .1 Apply paint by brush, roller, air sprayer or airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
 - .1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
 - .2 Work paint into cracks, crevices and corners.
 - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
 - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple.
 - .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Spray Application:

- .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
- .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
- .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
- .4 Brush out immediately runs and sags.
- .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.
- .5 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .7 Sand and dust between coats to remove visible defects.
- .8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.
- .9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.
- .2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .3 Do not paint over nameplates.

3.7 FIELD QUALITY CONTROL

- .1 Field inspection of exterior painting operations to be carried out by independent inspection firm as designated by Departmental Representative or Designate.
- .2 Advise Departmental Representative or Designate when each surface and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
- .3 Co-operate with inspection firm and provide access to areas of work.

3.8 RESTORATION

- .1 Clean and re-install all hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Material and installation of site applied paint finishes to new interior surfaces, including site painting of shop primed surfaces.
- .2 Related Sections:
 - .1 Section 01 33 00 - Submittal Procedures.
 - .2 Section 01 45 00 - Quality Control.
 - .3 Section 01 61 00 - Common Product Requirements.
 - .4 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .5 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

- .1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 Master Painters Institute (MPI)
 - .1 MPI Architectural Painting Specifications Manual.
- .3 Society for Protective Coatings (SSPC)
 - .1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

1.3 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.
 - .2 Journeymen: qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work.
 - .3 Apprentices: working under direct supervision of qualified trades person in accordance with trade regulations.
- .2 Pre-Installation Meeting:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations.
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Coordination with other building subtrades.

- .4 Review manufacturer's installation instructions and warranty requirements.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit product data and instructions for each paint and coating product to be used.
 - .2 Submit product data for the use and application of paint thinner.
 - .3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application and curing.
- .3 Samples:
 - .1 Submit full range colour sample chips to indicate where colour availability is restricted.
 - .2 Submit duplicate 200 x 300 mm sample panels of each paint, stain, clear coating and special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards.
 - .3 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation and application instructions.
 - .4 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:
 - .1 Product name, type and use.
 - .2 Manufacturer's product number.
 - .3 Colour numbers.
 - .4 MPI Environmentally Friendly classification system rating.

1.5 MAINTENANCE

- .1 Extra Materials:
 - .1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.
 - .2 Quantity: provide one - one litre can of each type and colour of primer, stain and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
 - .1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Acceptance at Site:

- .1 Identify products and materials with labels indicating:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
- .3 Remove damaged, opened and rejected materials from site.
- .4 Storage and Protection:
 - .1 Provide and maintain dry, temperature controlled, secure storage.
 - .2 Store materials and supplies away from heat generating devices.
 - .3 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.
- .5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.
- .7 Remove paint materials from storage only in quantities required for same day use.
- .8 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces in accordance with Section 01 35 30 Health and Safety Requirements.
 - .2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.
 - .3 Provide continuous ventilation for seven days after completion of application of paint.
 - .4 Coordinate use of existing ventilation system with Departmental Representative or Designate and ensure its operation during and after application of paint as required.
 - .5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
 - .6 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:

- .1 Unless pre-approved written approval by product manufacturer, perform no painting when:
 - .1 Ambient air and substrate temperatures are below 10 degrees C.
 - .2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.
 - .3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.
 - .4 The relative humidity is under 85 or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.
 - .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
 - .6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.
- .2 Perform painting work when maximum moisture content of the substrate is below:
 - .1 Allow new concrete and masonry to cure minimum of 28 days.
 - .2 12% for gypsum board.
- .3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".
- .4 Test concrete and masonry surfaces for alkalinity as required.
- .3 Surface and Environmental Conditions:
 - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
 - .3 Apply paint when previous coat of paint is dry or adequately cured.
- .4 Additional interior application requirements:
 - .1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

Part 2 Products

2.1 MATERIALS

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Provide paint materials for paint systems from single manufacturer.

- .3 Conform to latest MPI requirements for interior painting work including preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.
- .5 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.
- .6 Provide paint products meeting MPI "Environmentally Friendly" ratings based on VOC (EPA Method 24) content levels.
- .7 Use MPI listed materials having minimum rating where indoor air quality (odour) requirements exist.
- .8 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:
 - .1 Water-based.
 - .2 Non-flammable.
 - .3 Manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
 - .4 Manufactured without compounds which contribute to smog in the lower atmosphere.
 - .5 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
- .9 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .10 Flash point: 61.0 degrees C or greater for water-borne surface coatings and recycled water-borne surface coatings.
- .11 Ensure manufacture and process of both water-borne surface coatings and recycled water-borne surface coatings does not release:
 - .1 Matter in undiluted production plant effluent generating 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to natural watercourse or sewage treatment facility lacking secondary treatment.
 - .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to natural watercourse or a sewage treatment facility lacking secondary treatment.
- .12 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.
- .13 Recycled water-borne surface coatings to contain 50% post-consumer material by volume.

- .14 Recycled water-borne surface coatings must not contain:
- .1 Lead in excess of 600.0 ppm weight/weight total solids.
 - .2 Mercury in excess of 50.0 ppm weight/weight total product.
 - .3 Cadmium in excess of 1.0 ppm weight/weight total product.
 - .4 Hexavalent chromium in excess of 3.0 ppm weight/weight total product.
 - .5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

2.2 COLOURS

- .1 Consultant will provide Colour Schedule after Contract award.
- .2 Colour schedule will be based upon selection of five base colours and three accent colours. No more than eight colours will be selected for entire project and no more than three colours will be selected in each area.
- .3 Selection of colours from manufacturer's full range of colours.
- .4 Where specific products are available in restricted range of colours, selection based on limited range.
- .5 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.
- .4 Thin paint for spraying in accordance with paint manufacturer's instructions.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

- .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 2 - Velvet-Like Finish	Max. 10	10 to 35
Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 35

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 5 - Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

.2 Gloss level ratings of painted surfaces as indicated and as noted on Finish Schedule.

2.5 INTERIOR PAINTING SYSTEMS

- .1 Concrete horizontal surfaces: floors:
 - .1 INT 3.2F - Concrete floor sealer.
- .2 Concrete masonry units: smooth face block:
 - .1 INT 4.2A - Latex G5 finish.
- .3 Galvanized metal: doors, frames, misc. steel.
 - .1 INT 5.3B: W.B Light Industrial over shop primer.
 - .2 INT 5.3K: W.B. Light Industrial (over W.B. Primer),
- .4 Gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
 - .1 INT 9.2A - Latex G3 finish (over latex sealer).

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 sheet.

3.2 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted.
- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test".

Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:

- .1 Gypsum board: 12%.
- .2 Concrete Block: 12%.

3.4 PREPARATION

.1 Protection:

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces.
- .2 Protect factory finished products and equipment.
- .3 Protect building occupants and general public in and about the building.

.2 Surface Preparation:

- .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
- .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .3 Place "WET PAINT" signs in occupied areas as painting operations progress.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

- .1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
- .2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
- .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
- .4 Allow surfaces to drain completely and allow to dry thoroughly.
- .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
- .6 Use trigger operated spray nozzles for water hoses.
- .7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

- .5 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
- .6 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes, blowing with clean dry compressed air or vacuum cleaning.
- .7 Touch up of shop primers with primer as specified.

3.5 APPLICATION

- .1 Apply paint by brush, roller, air sprayer or airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
 - .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
 - .2 Work paint into cracks, crevices and corners.
 - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
 - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
 - .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Spray application:
 - .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
 - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
 - .3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.
 - .4 Brush out immediately all runs and sags.
 - .5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.
- .5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

- .7 Sand and dust between coats to remove visible defects.
- .8 Finish surfaces both above and below sight lines as specified for surrounding surfaces.
- .9 Finish closets and alcoves as specified for adjoining rooms.
- .10 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.
- .2 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .3 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .4 Do not paint over nameplates.
- .5 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .6 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .7 Paint natural gas piping yellow.
- .8 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.7 FIELD QUALITY CONTROL

- .1 Painting contractor shall notify Departmental Representative or Designate a minimum of two weeks prior to commencement of work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.
- .2 Standard of Acceptance:
 - .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
 - .2 Ceilings: no defects visible from floor at 45 degrees degrees to surface when viewed using final lighting source.
 - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 RESTORATION

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative or Designate. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative or Designate.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .2 ASTM B456, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
 - .3 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .4 ASTM A924/A924M, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
 - .2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.
 - .3 CAN/CGSB-12.5-M86, Mirrors, Silvered.
 - .4 CGSB 31-GP-107Ma-90, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-B651-, Barrier-Free Design.
 - .2 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Samples to be returned for inclusion into work.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/ Demolition Waste Management And Disposal.

1.7 EXTRA MATERIALS

- .1 Provide special tools required for accessing, assembly/disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.
- .2 Deliver special tools to Departmental Representative or Designate.

Part 2 Products

2.1 MATERIALS

- .1 Sheet steel: to ASTM A653/A653M with ZF001 designation zinc coating.
- .2 Stainless steel sheet metal: to ASTM A167, Type 304, with satin finish.
- .3 Stainless steel tubing: commercial grade, seamless welded, brushed finish.
- .4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 COMPONENTS

- .1 Acceptable Manufacturers:
 - .1 ASI Group Canada.
 - .2 Bobrick.
 - .3 Bradley.
- .2 Toilet paper holder (TPH): double roll type, surface mounted, stainless steel frame, capacity of 500 double ply roll, roll under spring tension for controlled delivery.
- .3 Hand Sanitizer (HSD): liquid or lather push-in valve 102 mm spout, self contained 340 mL translucent polyethylene tank, stainless steel piston and valve assembly, tamper proof filler lock, surface mounted, exposed metal components chrome plated.
- .4 Feminine napkin/tampon dispenser (SND): stainless steel surface unit, min capacity 15 napkins and 20 tampons, free operation, key locked, continuous hinge front panel.

- .5 Feminine napkin disposal bin (SNR): stainless steel, surface unit, continuous hinged door, self closing, embossed with universally accepted symbol, removable plastic receptacles fitted with spring clip for deodorizer block.
- .6 Grab bars (GB1/ GB2) : 38 mm dia x 1.6 mm wall tubing of stainless steel, 76 mm diameter wall flanges, exposed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories. Knurl bar at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2 kN. At all Barrier Free washrooms. Refer to drawings for dimensions.
- .7 Soap holder: surface mounted, 5 mm thick stainless steel dished tray, self draining, flush screws.
- .8 Coat hook (CH): stainless steel with 75 mm projection.
- .9 Mirror with Shelf (MIR/S): wall mounted unit, fixed framed mirror 6 mm to CAN/CGSB-12.5, stainless steel frame. 410mm x 510mm at all washroom sinks. 410mm x 760mm tilted mirror at Barrier Free washroom sinks.
- .10 Paper Towel Dispenser (PTD1) and recessed Waste Receptacle (WR-R): stainless steel, touch-free roll towel mechanism, accepts standard-core rolls up to 205mm wide, 205mm diameter, 244mm long, dispenses one 300mm length of paper towel per pull. Cabinet equipped with tumbler lock. Door secured to cabinet with a full length stainless steel piano-hinge and equipped with a concealed tumbler lock. Waste receptacle secured to cabinet with a tumbler lock.
- .11 Baby Change Station (HBCS): Surface-Mounted Horizontal Design Baby Changing Stations: 35"Wx22"H. FDA approved injection-molded polypropylene. Concealed pneumatic cylinder providing controlled, slow opening and closing of the changing station bed.
 - .1 Locations: As shown on Drawings.
 - .2 Hinge Mechanism: Reinforced full length steel-on-steel hinge.
 - .3 Changing Surface: Contoured, concave and smooth, 450 sq. in.
 - .4 Safety Straps: Replaceable, snap-lock, nylon protective holding straps.
 - .5 Performance:
When mounted to specification, unit has been tested to 300 lbs and will deflect less than 1 degree from 90 degrees with a 200 lb static load placed in the center of the changing surface.
- .12 Water Refill Station: see Mechanical.
- .13 Outhouse Toilet Cone: 460mm high fibreglass toilet cone with centre throat by Far North Fiberglass or approved equal.
- .15 Premanufactured Access Hatch: 800mmX800mm watertight, stainless steel with EDPM rubber seals access hatch by Westatlantic Tech Corp or approved alternate.

2.3 FABRICATION

- .1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.
- .2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.
- .3 Brake form sheet metal work with 1.5 mm radius bends.
- .4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- .5 Back paint components where contact is made with building finishes to prevent electrolysis.
- .6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CSA G164.
- .7 Shop assemble components and package complete with anchors and fittings.
- .8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.
- .9 Provide steel anchor plates and components for installation on studding and building framing.

2.4 FINISHES

- .1 Manufacturer's or brand names on face of units not acceptable.

Part 3 Execution

3.1 INSTALLATION

- .1 Install and secure accessories rigidly in place as follows:
 - .1 Hollow masonry units : use toggle bolts drilled into cell/wall cavity.
 - .2 Toilet compartments: use male/female through bolts.
- .2 Install grab bars on built-in anchors provided by bar manufacturer.
- .3 Use tamper proof screws/bolts for fasteners.
- .4 Fill units with necessary supplies shortly before final acceptance of building.
- .5 Install mirrors in accordance with Section 08 80 50 - Glazing.

3.2 SCHEDULE

- .1 Locate accessories where indicated and as follows.
- .2 Toilet tissue dispenser: one in each toilet compartment mounting height 710 mm F.F.F.

- .3 Paper towel dispenser: one in each washroom. Maximum height of dispenser and operable part from floor 1200 mm.
- .4 Soap dispenser: one at each wash basin.
- .5 Feminine napkin/tampon dispenser: one for each female washroom. Maximum height of dispenser and operable part from floor 1200 mm
- .6 Feminine napkin disposal bin: one in each female toilet compartment mounting height 755 mm F.F.F.
- .7 Grab bar: two in each handicapped toilet compartment. Height of grab bar from floor 750 mm. Side grab bar: maximum distance from rear wall 300 mm, minimum distance passed front edge of toilet 450 mm.
- .8 Mirror: one at each wash basin, height of bottom edge of mirror from floor 1000 mm.

END OF SECTION

1 GENERAL

1.01 REFERENCE

- .1 Read the Project Agreement and Division 01.
- .2 Section 26 05 01 forms an integral part of the scope of work for the Electrical Contractor and will be referenced until completion of the contract.
- .3 Throughout these specifications and the associated electrical documents the following references shall be applied;
 - .1 Within their Price, the Electrical Contractor shall allocate the associated costs to provide assistance in the coordination, some field manpower, and offer his expertise as an electrician to professionally execute the work. The final state of the work shall ensure it benefits the Departmental Representative's Project Administration Team, Architect's vision and the overall good for the project.
 - .2 The term Electrical Contractor or Contractor or Project Co Party shall be used within the drawings and specifications. Read this to mean the Electrical Contractor's scope of work.
- .4 The term "Provide", "Supply" and "Installed" shall be governed by the definition outlined within the Conditions of the Contract.

1.02 INTENT

- .1 The Electrical Contractor shall include within his Price all field and office administration labour, equipment, equipment incidentals in order to provide and execute the complete work as specified within the Electrical Documents.
- .2 This project and its documentation demand a significant amount of the Contractor's office administration manpower more than what he may be accustomed too therefore, the Electrical Contractor shall ensure all associated administration costs are carried within his Price. In addition to his project administration duties, the Contractor shall be responsible to provide the following;
 - .1 Provide detailed conduit routing drawings, identifying conduit system types and sizes etc.
 - .2 Provide assistance and information in the preparation of interference drawings.
 - .3 Provide electronic files to the Consultants for all milestone submissions c/w with full size set(s) of white prints.
 - .4 Provide final electronic files and white prints of record (as-built) drawings to both the Consultant and Departmental Representative's Project Administration Team.
 - .5 Provide as noted completed mock-ups, sample boards, material samples, etc. well in advance of the construction schedule for review by the prime Consultant.
 - .6 Provide and submit to the Consultants fully compliant and Contractor reviewed shop drawings. Failure to execute this process shall be the Contractor's responsibility for any scheduling impacts if the submissions are rejected during the review process.

1.03 LETTER AWARD OF CONTRACT

- .1 Prior to commencing the work the Electrical Contractor, the Departmental Representative's Project Administration Team reserves the right to meet with the Electrical Contractor. The purpose of the meeting is to discuss with, and ensure the Electrical Contractor has a full understanding of the project and it's deliverables.

1.04 MONTHLY DRAWS

- .1 Provide a sample of the project's monthly progress draw for review and acceptance. A detailed draw is expected for example:
 - .1 Distribution Equipment;
 - .1 Conduit Rough-in (6.25% of Total Value)
 - .2 Feeders Installed (6.25%)
 - .3 Equipment Supplied to Site (12.5%)
 - .4 Equipment Installed (24%)
 - .5 Equipment Energized (6.25%)
 - .6 Equipment Commissioned (6.25%)
 - .7 Equipment Test Reports Submitted (12.5%)
 - .8 Equipment Spare Parts Submitted (18.75%)
 - .2 The above sample shall also be applied to but not limited to the following:
 - .1 Lighting
 - .2 Telecommunications
 - .3 Security
 - .4 Fire Alarm
 - .5 Branch Circuit-Power
 - .6 Distribution Equipment.
 - .7 Nurse Call Systems
 - .8 Security System
 - .9 Miscellaneous Systems (ie AV)
- .2 Provide a sample change notice breakdown for review and acceptance.
 - .1 Sample shall include Conduit Prices, Unit Prices etc.
 - .2 Labour Rates all associated Incidentals
- .3 The Contractor shall be responsible to ensure all schedules, list(s), etc. have been submitted and that his schedules are updated accordingly prior to submission to the Prime Consultant and Departmental Representative's Project Manager Team.

1.05 CONTRACT DOCUMENTS

- .1 Wherever differences occur between plans, riser diagrams or schematics, or between specifications and drawings, the maximum condition shall govern and shall be carried within the Price.
- .2 Bring discrepancies between plans and actual field conditions promptly to the attention of the Consultant for clarification.
- .3 Contractor shall make on-site field verifications of dimensions noted on plans since actual locations, distances, and levels shall be governed by actual field conditions.
- .4 As the work progresses and before installing any apparatus, equipment, fixtures or devices which may interfere with the treatment and use of the building, obtain from the Prime Consultant a drawing or instruction for the location of the electrical equipment.
- .5 Install all conduits, wireways, etc., to conserve headroom and keep any interference to a minimum with the free use of the space through which they pass.
- .6 Install conduits, wireways, etc., only after the locations have been fully coordinated with all the other trades by submitting electronic interference and conduit routing drawings.
- .7 Take special care in the installation of conduits, wireways, etc., which are to be concealed to ensure that they come within the finished lines of floors, walls and ceilings.

- .8 Where such conduits, wireways, etc., have been installed in a manner as to cause interference, the Contractor shall remove and reinstall them in suitable locations without extra cost to the Departmental Representative.
- .9 Do not remove or damage any structural fireproofing. Leave space to permit the fireproofing to be inspected and/or repaired.
- .10 Before commencing work, check and verify with the Contractor and Civil Contractors all grade and invert elevations, levels, dimensions etc., to ensure proper and correct installation of the work.
- .11 In addition to the electrical scope of work identified within these documents, provide the items as required by the authorities having jurisdiction.
- .12 Install ceiling mounted components (luminaires, speakers, etc.) in accordance with the architectural reflected ceiling plans.
- .13 The Electrical devices noted within the plans shall not be dimensioned as plans identify the quantity of devices, luminaires, equipment etc. only. The Contractor shall reference the architectural plans.
- .14 Coordinate with all trades and provide interference drawings prior to any installation of work. Revise locations, routing of conduits, etc. to avoid conflict without extra cost to the Departmental Representative.

1.06 CONTRACTOR'S SHOP

- .1 Provide a job site office, workshop, tools, scaffolds, material storage, etc., as required to complete the work of this contract and as directed by Project Co.
- .2 The electrical contractor's office should as a minimum have the following capabilities,, high speed internet connection, complete with a spare port and patch cable in order that the Consultant can access the internet to deal with and expedite project related issues.

1.07 CLEANING

- .1 The Electrical Contractor shall;
- .2 Protect and clearly identify all equipment including the equipment installed during the rough-in stage of construction. Note failure to identify the rough-in equipment will affect progress draw submission as the Inspecting Consultant cannot quantify the submission.
- .3 During the performance of the work and on it's completion, remove from the site and premises all debris, rubbish and waste materials caused by the work for this contract. Remove all tools and surplus materials after completion and acceptance of the work.
- .4 Vacuum all equipment thoroughly at the time of final acceptance and of the work. Clean plastic components and exposed components of luminaires.
- .5 All equipment shall be professionally cleaned prior to turn over.

1.08 TEMPORARY SERVICES

- .1 Refer to General Contract Conditions.

1.09 PHASING / STAGING CONCEPT

- .1 The overall electrical phasing must be in concert and support the Project's Phasing Plan.
- .2 With respect to scheduling the Electrical Contractor shall meet all requirements of the Contractor and the requirements identified in the Construct documents.

- .3 It is imperative that the Electrical Contractor prior to his Price Submission fully understands the phasing plan as it relates to, the existing systems operation, interconnections and the installation of new power and communication systems.
- .4 All system shut downs and interruptions must be coordinated with the Contractor, Departmental Representative and the Consultants. The Facility's operation is the primary concern and will be the guiding principle in the coordination of shut downs.
- .5 Coordinate with the Contractor for the completed areas to be turned over to the Departmental Representative's Project Administration Team in a manner consistent with the phasing approach for this project.
- .6 At each turn over meet the requirements as reflected in the Electrical specifications.
- .7 Carry all associated costs and labour in the electrical Price with respect to phasing and phased turn-over areas, as multiple testing system verifications will be required, for example multiple fire alarm tests etc.

1.10 SCHEDULING OF WORK

- .1 For all work to be performed under this contract, adhere to the construction schedule detailed in the Contract Documents
- .2 Contain all work being performed within the physical area of work which is underway during any particular period of time. Keep the amount of disruption in the existing facility to a minimum.
- .3 The Contractor shall forecast and schedule his execution of the Electrical Scope of Work requirements well in advance so as to identify any conflicts. Requiring an immediate response from the Consultant due to poor planning will not be acceptable nor shall the Consultant's response time be initiated as a reason to delay of any milestones.
- .4 Coordinate with Contractor and Commissioning Consultant for schedule of Electrical Commissioning to ensure that the work shall be complete prior to the phased occupancy date.
- .5 Should the work within a particular area cause any electrical apparatus in another area to cease to function properly, modify and reconnect this apparatus which has ceased to function properly. The Electrical Contractor shall notify all parties prior to modifications.

1.11 INSTALLATION OF WORK

- .1 The Contractor shall be responsible for:
 - .1 The layout of the work of this contract, and for any damage caused to DEPARTMENTAL REPRESENTATIVE's equipment by this installation, or other contracts by improper location or carrying out of this work.
 - .2 The prompt installation of the work of this contract in advance of concrete pouring or similar work.
 - .3 The protection of finished and unfinished work and equipment and work of other contracts from damage due to the carrying out of the work of this contract.
 - .4 The condition of all material and equipment supplied under this contract, and for the protection and maintenance of work completed throughout the construction period.
- .2 To confer with other trades engaged on the Project and arrange the work so that it will be carried out in the best interest of The Project.
- .3 To furnish items to be "built-in" in ample time and give any necessary information and assistance in connection with the building of the same.

- .4 To notify the Prime and Structural Consultants of the size and location of recesses, openings and chases before floors, walls, etc. are erected. Submit electronic and a hard copy set of conduit drawings prior to any concrete pours identify where openings in slabs or sleeves are required.
- .5 To proceed with the work as quickly as practically so that construction may be completed in as short a time as possible and in accordance with the Project schedule.
- .6 To ensure that all equipment and material is ordered in time to meet the construction schedule. The Electrical Contractor shall provide a schedule of equipment deliveries to the Contractor and the Prime Consultant after award of contract. Coordinate with Contractor and ensure that the equipment shall be delivered and in place prior to closing of the building/slab. Areaways are not designed for bringing equipment in. It is the responsibility of the contractor to coordinate this requirement.
- .7 Furnish promptly information required for the construction schedule.
- .8 Manufactured products supplied with instructions for their use shall be used in strict accordance with those instructions.
- .9 Plug and cap all conduits until they are ready for pulling wires and making connections. Duct tape will not be acceptable, plastic conduit plugs or clasps shall be used. Ensure caps are labelled for visual inspection. Cover and protect all fixtures and equipment against dirt, water, chemicals or mechanical injury. Re-touch, refinish or replace any equipment or materials damaged in shipment or during the construction prior to final acceptance at no cost to the Departmental Representative. Any cost associated to damage equipment shall be arranged between the Contractor and his sub-trades only.
- .10 If a portion of slab on each floor is pre-cast slab. Include all cost in contract for all required additional work such as coordination, provision of drawings for approval, labour, etc.
- .11 If the slab on each floor is poured in phases. Provision shall be provided for all in slab conduits. Sleeves shall be provided to join the conduits for the subsequence pours. Ensure the conduit systems shall be free of debris and continuity of the conduit systems is maintained.
- .12 Where boxes embedded in concrete or installed in areas that the finished panels/materials shall be applied, extension rings and/or custom boxes shall be provided to ensure that there shall be no gap between the boxes and the outlets. These conditions shall apply to most but not limited to outdoor applications offices. Examine the Architectural drawings for other areas and include costs in Price.
- .13 Provide required materials for conduit crossings at expansion joints, both surface and recess type.

1.12 CODES, PERMITS, FEES AND INSPECTION

- .1 All work shall meet or exceed the latest requirements of the Ontario Electrical Code, its Supplements and local inspection bulletins.
- .2 Obtain all permits and arrange for inspection of all work and pay all fees in this regard. On completion of the work, deliver the final unconditional "Certificate of Approval of the Authority Having Jurisdiction" to the Prime Consultant. Inspection fees are the responsibility of the Electrical Contractor. Multiple inspections and fees shall be carried in the Price to allow the Departmental Representative's Project Administration Team to move in sequentially.
- .3 It is hereby agreed that all requirements have been examined and checked with the Electrical Safety Authority and a complete installation shall be in accordance with these requirements which will be provided in the Price Submission.

- .4 The Contractor shall keep a permanent record of each inspection made by the Electrical Safety Authority showing the dates, inspector's name, scope of the inspection and statement of special decisions or permissions granted. Make these records available to the Consultants at any time, and turn them over after completion of the work. Contractor must have them included in the manuals.

1.13 MANUFACTURERS' AND CSA LABELS

- .1 Must be visible and legible after equipment is installed.

1.14 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety. Follow all requirements of the UTILITY, Authority Having Jurisdiction, the Contractor and Departmental Representative's Health and Safety Regulations.

1.15 MATERIALS

- .1 Refer to Project documents and as specified herein.
- .2 Where materials, equipment, apparatus, or other products are specified by manufacturer, brand name, type or catalogue number, such designation is to establish the standards of desired quality, style or dimensions and shall be the basis of the Price. Furnish materials so specified under this Contract unless changed by mutual agreement. Where two (2) or more designations are listed, the Contractor shall choose one (1) of those listed and state the choice made in Supplementary Form, "Equipment and Material List", refer to Appendix.
- .3 Where the use of equivalent, alternate or substitute equipment alters the design or space requirements indicated on the plans, the Contractor shall include all items of costs for the revised design and construction, including the cost of all other trades and the Consultant's time involved to review the alteration.
- .4 Acceptance of the proposed equivalents, alternates or substitutions shall be subject to the review by the Consultants and Departmental Representative and if requested, the Contractor shall submit for inspection, samples of both the specified and the proposed alternate items.
- .5 In all cases where the use of equivalents, alternates or substitutions is permitted, the Contractor shall bear the extra costs, including the Consultant's and Departmental Representative's time, on a time and material basis of evaluating the quality of materials and the equipment to be installed.

1.16 EQUIVALENTS AND ALTERNATES

- .1 Unless requests for changes in the Specifications are received, the Contractor will be held to furnish all specified items under his Price. After the Contract is awarded, changes in specifications will be made only as defined in Section – 01 60 00.
- .2 The Contractor shall replace unspecified or rejected materials built into the work with specified or accepted materials at no additional cost to the project.

1.17 MATERIAL SUBSTITUTION

- .1 After execution of the Contract, requests for substitution of materials of makes other than those specifically named in the Contract Documents may be considered by the Consultant and Departmental Representative subject to the following:

- .1 The specified material cannot be delivered to the job in time to complete the work in proper sequence to work of other trades, due to conditions beyond the control of the Contractor. Refer to shop drawing submission section.
- .2 Requests for substitutions shall be accompanied by documentary proof of equality, difference in price and delivery, if any, in the form of certified quotations from suppliers of both specified and proposed equipment. Blanket statements will not be accepted.
- .3 In case of difference in price, the Departmental Representative shall receive all benefits of the difference in cost involved for any substitution and the Contract altered by a change order to credit the Departmental Representative with all savings obtained.
- .4 Materials and equipment substituted or offered as alternatives shall have spare parts and servicing available and shall fit into the space allocation shown on the drawings.
- .5 If any material or equipment being considered for substitution involves additional design, architectural or engineering, fees or other costs in confirming whether or not the substitute material or equipment is suitable for the project, such fees or costs shall be paid for by the Contractor. The consultant's per diem rate shall be supplied to each piece of device or equipment requested for review. There is no guarantee that the reviewed product shall be approved by the Departmental Representative's Project Administration Team and/or reviewing Consultant.

1.18 SHOP DRAWINGS

- .1 Submit shop drawings in accordance to the Electrical Specification and section 01 33 00.
- .2 After award of the Contract, the Contractor shall provide a detailed schedule for shop drawing submissions and a schedule for the delivery of the equipment to the site. The Contractor shall identify any equipment whose delivery time will negatively impact the project completion date. Failure to do so will require the Contractor to provide temporary equipment if approved until the specified equipment is available. No extra costs shall be paid to the Contractor for the above.
- .3 Shop drawings shall be complete with dimensions, weight (self & operating), recommended housekeeping pad dimensions, inertia pads, etc. so that it can be reviewed by Structural, and other applicable Consultants, etc.
- .4 Prior to detailing reinforcement, the Contractor must submit drawings of the structure showing formed holes, recesses and sleeving required under all sections. The submission shall be complete with dimensioned openings, recesses and sleeves and relate to suitable grid lines and elevation.
- .5 With his shop drawing Submission Schedule, the Contractor shall make a Priority List for the Consultant's review. If not identified, the Consultant will review shop drawings at his discretion if all submitted at once.
- .6 Submission of shop drawings shall be made in an organized manner that corresponds with the Construction Schedule.
- .7 It is the Contractor's responsibility to fully review and seal his shop drawings prior to issuance to the Consultants.
- .8 The Consultant shall not be held responsible for rejected shop drawings as it relates to the Construction Schedule.
- .9 The Electrical Consultant will review and process shop drawings within ten (10) working days of his receipt, for each individual item, not when the Contractor or Contractor submitted them. Ten days will not be revised regardless of the time frame noted anywhere in the project's Contract documents.

1.19 SAMPLES

- .1 Submit samples of electrical equipment, colours of equipment, etc., for review by the Prime Consultant as specified. Samples shall remain on site until completion of the project. Final fabrication of equipment shall only occur until the Prime Consultant's selection. The Contractor shall identify the response time required, as a minimum allow for two (2) weeks.

1.20 ELECTRONIC AS BUILT DRAWINGS

- .1 The Consultant will provide to the Contractor(s) one set of Electronic drawings on computer disk based on Project's Delivery Program Version, for the purpose of preparing interference conduit routing drawings. As the job progresses, mark up the white prints to accurately indicate installed work, i.e. location and elevations, etc. On completion of the work, transfer the information neatly onto the electronic files based on Similar Program Version, and submit the disks and one set of prints for review. Correct the disks as directed and hand these over to the Consultant, together with a set of white prints, on completion. Complete all computer schedules as deemed necessary
- .2 The Electrical Contractor shall record, as the job progresses, all approved changes and deviations made to any work shown on the original contract drawings whether by addenda, requested changes, job instructions, and changes due to Project conditions.
- .3 The Electrical Contractor shall indicate on the drawings all buried services and their elevations, pull boxes, junction boxes, empty conduits, concealed main and sub-feeder conduits and any other equipment not clearly in view, with exact dimensions for future reference. Tie dimensions by measurement to existing topographical features, and include changes in directions as well as at least three (3) points on straight runs of conduits, etc. Include photographs c/w reference points on drawings.
- .4 As Built drawings shall be kept up to date and be available for checking at any time by the Consultant. Failure to produce drawings may cause the reduction to requested monthly Progress Draws. In addition the Contractor will provide updated record drawings as noted in the Contract Documents. Drawings to be submitted to Contractor for distribution. Minimum three (3) copies, one for Electrical Consultant, one for Departmental Representative's Project Administration Team, and one for Contractor. Each submission shall be clearly identified.
- .5 Final As Built drawings shall be submitted four (4) weeks prior to the requested date of substantial completion.
- .6 The Electrical Contractor shall present all data reports directly on the electrical As Built set Drawings by scanning selected portions of the electrical shop drawings into the set, preferably next to where the equipment is shown on plans or as an additional data sheet having an additional "E" number drawing. (The purpose of this is the creation of a fully integrated user friendly document containing all vital data in a single package). This will include such reports as Panel Data, Circuit Numbering, Motor Control Centre Information, etc.

1.21 TEMPORARY AND TRIAL USAGE

- .1 After any substantial part of the work of this contract has been completed, the Contractor, Prime Consultant, Departmental Representative and Consultants shall make inspections together. The Contractor shall carry out performance tests of such parts under the direction of the Consultant. If deficiencies are found, he shall rectify them immediately to the satisfaction of the Consultant and Departmental Representative. After such deficiencies are rectified, place the work in service. If, in placing a portion of the equipment in service, it is necessary to make temporary connections in the wiring in order to obtain proper operation,

provide such connections in the manner required by the Consultant/Departmental Representative.

- .2 Temporary or trial usage of any electrical devices, machinery, apparatus, equipment or materials will not be construed as evidence of the acceptance of same.
- .3 No claims for damages will be considered for injury to, or the breaking of any parts of such work which may be used.

1.22 CONSULTANT'S INSTRUCTIONS

- .1 During construction, the Consultant will issue such individual instructions as may be necessary for verification and clarification of the work. The contractor shall complete work as instructed within the instruction. Each instruction shall be individually numbered for tracking purposes, the number of instructions shall not be considered as a poor reflection of the documents.

1.23 CHANGE NOTICES AND CHANGE DIRECTIVES

- .1 No additional money over and above the Contract Price will be paid for extra work unless a written order, signed by the contracting authority for such work to proceed is given.
- .2 When change or additional work is required, the Consultant will issue a notice of contemplated change, together with revised plans if necessary, identifying the additions, deletions or alterations required.
- .3 When and if the change price is accepted, a change order will be issued by the Prime Consultant and after contracting authority signing, and only then, may the work listed be carried out.
- .4 The Contractor's promptness in submitting his review is essential.
- .5 Change directives shall be governed by the terms as outlined within the Project Agreement.
- .6 Upon issuance of the change, the Contractor shall provide the following;
 - .1 The Contractor immediately evaluate these changes and submit the price to the Consultants.
 - .2 When and if the price is approved, a change order will be issued by the Prime Consultant and then, and only then, may the work listed be carried out. The Contractor's promptness in submitting is essential
 - .3 Submit a complete breakdown of labour and material involved.
 - .4 Provide separate unit prices for each item of labour and material.
 - .5 All support documentation from the distributor.
 - .6 Submitting lump sum prices for extras and/or credits will not be accepted. Contractor shall advise his Distributor.
 - .7 Contractor shall offer to the Departmental Representative the benefit of utilizing previously installed services, ie conduits large enough to accommodate additional wiring etc. minimizing the change notice overall quote.
- .7 When the request for change is issued, the contractor shall examine the Scope of Work description and define the affected area. Do not progress the work in the affected areas until the changes are approved. If this process shall delay the schedule, the Contractor shall inform Project Co.
- .8 All purchase orders breakdowns shall be submitted that will be applied to change notices. The purchase orders shall include but, not limited to the following;
 - .1 Submit all data in accordance to the Contract documents.
 - .2 Submit the cost and "locked-in rates" for each conduit size and types.
 - .3 Submit the cost and "locked-in rates" for each wire size and types.

- .4 Cost for scaffolding, lifts, etc and their associated rental rates. Scheduling shall be reviewed at the time of the change notice sample submission with Departmental Representative's Project Administration Team.
- .5 Cost for miscellaneous tools and shall be clearly identify what "miscellaneous" is interpreted as.

1.24 REQUESTS FOR INFORMATION - RFI

- .1 The successful Contractor may submit if he chooses, a Request for Information also known as an RFI to the Consultant(s) for clarification to an item within his Scope of Work.
- .2 It is understood that an RFI is a form of dialogue between the Contractor and Consultant(s).
- .3 The quantity of RFIs generated during the project's construction is no reflection of the quality of the electrical documents, nor shall the quantity of RFIs form the basis of a delay claim.
- .4 In order to expedite the RFI response time, the RFI must be clearly identified and directed to the Consultant responsible for that work.
- .5 The RFI shall be submitted to the Consultant(s) in a timely manner with a minimum of one (1) month look ahead for its related work. The Contractor shall be responsible that the construction schedule is never impacted.
- .6 An RFI will not be accepted nor shall it be submitted after 1500hrs (EST) to the Consultant. If the RFI is submitted after the time specified then it shall be dated for the next working day.
- .7 The Contractor shall never place the Consultant in a situation where, due to poor planning and issuance of the RFI requires an immediate response putting a deliverable date in jeopardy.
- .8 It is the Electrical Contractor's responsibility to notify the Contractor and ensure he directs the RFI to the respective Consultant for example, a slab core drilling request shall be directed to the Structural Engineer, the Electrical and Prime Consultants shall be copied.
- .9 The Contractor shall avoid issuing an RFI with requesting clarification for multiple subjects. One item per RFI so as to expedite response times
- .10 The Electrical Consultant reserves the right to process each RFI within five (5) working days. Issuance of the RFI shall factor in the response time and the construction look ahead.
- .11 To assist the process, the contractor shall identify the level of priority for example, low medium high.

1.25 VOLTAGE RATINGS

- .1 Provide operating voltages in accordance with Standard CAN3-C235-83 Latest Standards.
- .2 Motors, electrical heating, control and distribution devices and equipment must operate satisfactorily at 60 Hz within the normal operating limits established by the above standard. Equipment must operate in the extreme operating conditions established in the above standard without damage to any equipment.

1.26 MOUNTING HEIGHTS

- .1 The mounting height of equipment is measured from the finished floor to the centreline of the equipment unless specified or otherwise indicated. The Electrical Contractor shall confirm mounting heights with the Architect prior to rough-in, unless code related.

- .2 Mounting height of wall receptacles in Departmental Representative spaces and corridors shall be at min 200 mm to the underside of outlets. Electrical Contractor shall coordinate outlet mounting heights with baseboards and Architectural layouts.
- .3 If the mounting height of any equipment is not indicated, verify the mounting height before proceeding with the installation.
- .4 Install electrical equipment at the following mounting heights unless otherwise indicated:
 - .1 local switches: 48" (1220 mm);
 - .2 wall receptacles:
 - .1 general: 16" (400 mm); Refer to Architectural Drawing for placement of device within block motor joints.
 - .2 above top of continuous baseboard heater: 8" (200 mm);
 - .3 above top of counters or splash back: 8" (175 mm);
 - .4 above counter without backsplash: 4" (100 mm)
 - .5 in mechanical rooms: 47" (1200 mm);
 - .6 for emergency lighting battery units: adjacent to the battery unit;
 - .7 outlets for institution equipment: 48" (1200 mm), unless noted on architectural documents.
 - .8 For areas classified as hazardous locations, install all electrical devices as per code requirements. Electrical Contractor shall obtain a copy of the Code Report and coordinate with Architectural drawings regarding such locations.
 - .3 panelboards:
 - .1 72" (1800 mm) to the top except that the panelboard shall not be lower than 6" (150 mm) above the finished floor;
 - .2 Where multiple panelboards are mounted together, align the tops of all the panelboards or trims with the highest panelboard determining the height.
 - .4 Telephone/data outlets: 16" (400 mm);
 - .5 Wall mounted telephone outlets: 48" (1220 mm); (ie pay phones)
 - .6 Emergency Call Outlets as per Departmental Representative Standards;
 - .7 Fire alarm stations: 48" (1220 mm);
 - .8 Fire alarm speakers: 84" (2300 mm) and in ceiling;
 - .9 Wall mounted speakers: 84" (2100 mm);
 - .10 Door bell pushbuttons: 48" (1220 mm);
 - .11 Emergency lighting battery units: 96" (2400 mm);
 - .12 Wall mounted dry type transformers: 96" (2400 mm) to the bottom;
 - .13 Individual starters:
 - .1 60" (1500 mm) to the top;
 - .2 where multiple starters are mounted together, align the tops of all the starters or trims with the highest starter determining the height;
 - .14 Splitters: 4" (100 mm) below the lowest equipment connected to the splitter.
 - .15 See relative specifications for other system devices and/or drawings.

1.27 FIREPROOFING

- .1 Where cables or conduits pass through floors and fire rated walls pack space between wiring and sleeve and seal with 3M fire stopping system and details or equivalent. Contact the representative to ensure that the installation shall meet manufacturer's requirements.
- .2 Care must be taken to keep integrity of all assemblies. The Contractor shall provide at the end of the project a letter from manufacturer indicating that the installation meets the requirements and ratings. .
- .3 Meet all requirements of the OBC and fire proofing requirements as specified under the Contract Documents.

- .4 Contractor shall submit shop drawing samples and in accordance to shop drawing submission requirements.

1.28 BASES SUPPORTS

- .1 Where conduit and equipment is located on walls or slabs which will not permit the support of equipment, provide suitable supports to the building structure. Supports shall be constructed of steel members or of steel pipe and fittings designed to safely support the equipment.
- .2 All equipment bases shall be set on pads of kinetic precompressed fibreglass or vibration isolators sized to suit the equipment which they ought to support.
- .3 Refer to acoustic requirements (available by Architect and/or contractor) for additional vibration isolators and requirements.
- .4 All hangers and connections to open web steel joists, must be made at the panel points. It is not structurally acceptable to impose any loads on either the top or the bottom chord of the joist, between panel points. Obtain the maximum working load that can be suspended from a joist panel point from the structural Consultant prior to installation of any work and strictly adhere to these requirements. Loads must be applied so that they do not cause twisting of the joints.

1.29 INSERTS, SLEEVES, CURBS AND OPENINGS

- .1 Provide all inserts, sleeves, curbs and housekeeping pads required for the work of this contract. All sleeved or formed openings through the structure must be shown on sleeving drawings which are to be submitted to all Consultants for review prior to construction. No holes through the structure will be permitted without written approval of The Prime and Structural Consultant.
- .2 Use only factory made threaded or toggle type inserts as required for support and anchors, properly sized for the load to be carried. Place inserts only in portions of the main structure and not in any finishing material.
- .3 Use factory made expansion shields where inserts cannot be placed, but only where approved by the Prime Consultant or structural and only for loads of 50 Kg or less.
- .4 Do not use power activated tools.
- .5 Supply and locate all inserts, holes, anchor bolts, sleeves and roof pitch pockets in time when walls, floors and roof are erected.
- .6 Size sleeves to provide 1" (25 mm) clearance all around.
- .7 Use the following sleeving materials:
 - .1 Through all interior walls use Schedule 40 steel pipes, machine cut, flush with finished structure. Check room finish schedules;
 - .2 Through all exterior walls above grade use schedule 40 steel pipes, machine cut, flush with finished structure inside and to suit flashing on outside;
 - .3 Through all foundation walls below grade and all other waterproof walls provide Link Seal type assembly. Check flashing details for further information. Clamp manufactured by Thunderline or Innerlynx.
 - .4 Through all waterproof floors, through washrooms, janitors closets, boiler rooms, mechanical rooms, kitchen and through roofs use wrought iron sleeves, machine cut. Extend sleeves 4" (100 mm) above finished floor upwards and cut flush with underside of floor.

- .8 Approved type plastic sleeves, conduit sleeves, or 18 gauge galvanized steel sleeves may be used as an alternative for Schedule 40 steel sleeves in interior areas.
- .9 Extra heavy weight cast iron sleeves may be used as an alternative for wrought iron sleeves.
- .10 Provide 4" (100 mm) high, 4" (100 mm) wide watertight concrete curbs with 0.8" (20 mm) chamfered edges around all sleeves and conduits passing through floors.
- .11 Sleeves are not required in walls and dry area floors, where conduit is installed ahead of wall construction.
- .12 The Electrical Contractor shall be responsible for packing all sleeves between the conduit or cable passing through the sleeve and the sleeve and all spare sleeves with loose fibreglass insulation. Seal the annular space both sides as follows:
 - .1 for all horizontal sleeves in exposed areas, use a seal of equal or better fire rating than the wall to be sealed;
 - .2 for all horizontal concealed sleeves through fire walls and through walls separating areas of different air pressure, use a permanently resilient silicone base or equal sealing compound;
 - .3 for all vertical sleeves through roofs, washrooms, janitor closets, equipment rooms, use permanently resilient silicone base or equal compound, non- flammable and waterproof. Ensure that the seal is compatible with floor and ceiling finishes. Check the room finish schedules for further information;
 - .4 Provide proper fire stop materials for sleeves that passing through fire rated walls and or assemblies.
- .13 Set and securely support sleeves, ties, anchor bolts, pipe hangers and other inserts, openings and sleeves, in concrete floors and walls, as required by all trades. Use setting diagrams, templates and instructions provided by others for location and setting.
- .14 Advise Prime Consultant, without delay, of any openings, sleeves, inserts and embedment required but not shown on the Structural Drawings or on reviewed shop drawings.
- .15 Sleeves, openings, etc., within slabs and walls greater than 50 mm square not indicated on Structural Drawings must be approved by the Consultant.
- .16 Do not provide for any openings or inserts within beams or columns without approval of the Structural Consultant.
- .17 Do not eliminate or displace reinforcement to accommodate hardware or waterstops. If inserts cannot be located as specified, obtain approval of all proposed modifications from Structural and Prime Consultant before placing concrete.
- .18 Check locations and sizes of sleeves, openings, etc., shown on Structural Drawings with Architectural, Mechanical and Contract Drawings.
- .19 Dissimilar embedded metals shall be separated by a minimum of 40 mm of concrete or shall be protected by electrically insulating coating or separators, for all concrete otherwise likely to be exposed to moisture. Stainless steel and plain steel shall be considered dissimilar metals.
- .20 In slabs and ramps, metallic embedment and inserts such as conduits, junction and fixture boxes, and other hardware shall conform to CAN/CSA-S413.

1.30 FLASHING

- .1 Coordinate with requirements for roofing, waterproofing and flashing with the Roofing Contractor and Prime Consultant's documents.

- .2 Flash electrical parts passing through or built into a roof, an outside wall or a waterproof floor.
- .3 Provide 8 pound sheet lead flashing for cast iron or wrought iron sleeves passing through roof.
- .4 Flashing shall suit roof angle and shall extend minimum 18" (450 mm) on all sides. Leave flashing as directed by the Contractor for him to build into roofing, rendering a watertight connection.
- .5 Provide counter flashing on stacks, ducts and pipes passing through roof to fit over flashing or curb.
- .6 Provide sleeves passing through outside walls with lead or copper flashing as directed.
- .7 Pay special attention to the waterproofing conditions of basements and walls and floors that may exist. Cooperate at all times with the Waterproofing and Concrete Contractors and do not cut or destroy any waterproofing seal without the consent of same. Provide sleeves passing through waterproof walls with asphalt roofing felt wrapped around so as to leave a 1" x 2" (25 mm x 50 mm) recess on both sides of the wall. Seal recesses and the space between conduit and sleeve as specified in contract specifications. See special details for concrete encased ducts passing through outside walls.
- .8 Provide a seal between cables and cable sleeves after installation is complete. Seal all spare sleeves.
- .9 Supply and install all pitch pockets for the electrical and building controls installations through the roof. Layout and cut deck at all locations requiring installation of pitch pockets.

1.31 ACCESS PANELS AND DOORS

- .1 Refer to assigned section.

1.32 PAINTING AND STENCILLING

- .1 All hangers, channels, conduits, etc. shall be delivered to the site galvanized after fabrication and all metal cut and finishes damaged on the job shall be painted to match.
- .2 All equipment and materials, panels, luminaires, etc., shall be stored in a dry, clean location, covered if necessary to preserve factory finish.
- .3 Where equipment and material is designated unfinished, all exposed metal work, with the exception of chromed locks and hardware, shall be left with a suitable prime coat finish.
- .4 Painting of equipment and material requiring a finished coat after installation will be carried out under the condition of the Contract. This does not apply to the making good of damaged factory finishes which shall be done by the Contractor for Electrical.

1.33 IDENTIFICATION AND LABELLING

- .1 Clearly identify all conduit and teck cable systems carrying feeder cables by painting the voltage of the system, feeder and circuit identification and any other wording that may be required at regular intervals on the conduits, on all splicing and pull boxes, on both sides of sleeves and at each floor on vertical risers. The actual wording and size of the letters and spacing of each inscription shall meet the requirements of Departmental Representative's Facility Manager and Consultant. The paint used shall be durable and resistant to chipping. Failure to carry out task will affect Progress Draws.
- .2 Identify all electrical equipment in accordance with Contract Specifications.

- .3 In pull boxes, junction boxes and at terminations, feeders shall be identified by plastic plates indicating system voltage and circuit designations, and individual conductors shall be identified with coloured tape or covering to show phase, neutral or ground connection. The plates shall be 1" (25 mm) in diameter and have letter stamped .6" (15 mm) high, and the colour coding shall be Phase A - red, Phase B - black, Phase C - blue, Neutral - white, and Ground - green. All shall be coordinated with Authorities.
- .4 The outer covering of branch circuit wiring shall be colour coded throughout all 600, 347, 208 V and 120 V systems: Phase A - red, Phase B - black, Phase C - blue, Neutral - White, and Ground - green. Identification shall suit the local inspector prior to installation.
- .5 Contractor shall paint the interior of all boxes (outlet, junction etc.) with a durable paint of a colour which identifies the system function. Junction box coverplate shall be painted as well. Once boxes and coverplates are dried descriptions and/or circuit numbers will be identified. Failure will affect monthly progress draw requests. The applicable colours are as follows:

SYSTEM	COLOUR
Lighting & Power - 120/208V	Grey
Emergency - 120/208V	Grey EM
UPS - 120/208V	Grey UPS
Lighting and Power - 347/600V	Orange
Emergency - 347/600V	Orange EM
Fire Alarm	Red
Telephone	Green "T" on cover
Data	Green "C" on cover
Cable TV	Green "AVTV" on cover
Security	Yellow
Surveillance	Yellow
Public Address System	N/A
Low Voltage Switching	Black
Indicate all circuit numbers on box painted coverplates. Provide circuit numbers on all face plate receptacle and switches/dimmers. Submit sample for review.	

- .6 All high, medium and low voltage raceways shall be labelled "DANGER 44 kV or 600V, or 208V", at 3 m intervals along raceway. Labels are to be white in colour with black lettering. Submit sample prior to manufacturing. Refer to Nameplate Specification for additional requirements.
- .7 Each wall mounted coverplates (for both switches/dimmers, receptacles and electrical controls) shall be security labeled and filled to indicate the physical locations of the outlet, its designation and the circuit numbers it terminates. Font shall be Bold Arial, 1/4" for panel location and designation and 3/16" for circuit numbers. Contractor shall coordinate and carry all associated costs or provided with a lamacoid nameplate fastened to the coverplate.
- .8 The Contractor shall submit all labelled coverplate samples to the Departmental Representative's Project Administration Team for approval prior to manufacturing.

1.34 NUMBER AND LOCATION OF OUTLETS

- .1 Provide outlets for light, power and systems of the number and in the locations shown on the drawings if identified on architectural drawings they shall govern. Locate all outlets accurately with respect to building lines and in centering outlets due allowance shall be made for overhead pipes, ducts, equipment and for variations in wall or ceiling finishes,

window trim, panelling, etc. When necessary, make adjustments to ensure that all outlets are properly centred. Install local lighting switches installed on the strike side of the door as finally set and accept responsibility for determining this before outlet boxes are installed. Refer to architectural documents for additional information. If not shown, Contractor shall coordinate with Architect prior to rough-ins.

- .2 The location of any outlet may be changed without extra cost or credit providing that the new location is within 20' (6 m) of that originally shown on the drawings and that instructions for the revision is issued prior to installation of the outlet.
- .3 Do not mount outlet boxes in walls and partitions back-to-back and provide a minimum of 6" (150 mm) between boxes. Provide acoustic insulating medium in conduits which join boxes on opposite sides of same wall or partition, refer to acoustic documents and details for additional information.

1.35 BRANCH CIRCUIT WIRING

- .1 Lighting and power panels are specified as sequence bussed unless noted and all branch circuit wiring for these panels shall be such that, where a common neutral is used for two (2) or three (3) circuits these circuits shall be fed from adjacent breakers so that single-pole breakers may be replaced with 2 or 3-pole breakers should this be so required in the future. All circuits shall be balanced. All wires including neutrals and grounds shall be labelled at both ends (tagged and labeled).
- .2 For all outlets for computers and UPS circuits, provide a separate neutral for each circuit. Shared neutral is not acceptable. This requirement is not applicable to furniture power connections. Wires shall be labelled at both ends. Contractor shall provide a sample for review.
- .3 Separate neutral and grounds shall be provided for all audio/visual circuits.

1.36 CONNECTORS AND TERMINALS

- .1 Wire connectors shall be of an approved type:
 - .1 pre-insulated spring type, consisting of coil of steel wire, hard steel shell and flexible polyvinyl insulation with long skirt extended beyond the bell end of the spring;
 - .2 tinned, copper compression type installed using the manufacturer's recommended tools and dies, and with positive locking insulating cap.
- .2 Use compression type tinned copper terminals for all conductor terminations except where bolted type terminals are supplied with equipment, such terminals to be of copper tinned overall.

1.37 MOTOR AND EQUIPMENT WIRING

- .1 Refer to Appendix B, Division of Responsibility for additional information.
- .2 Provide power wiring connection and, fittings external to all motors, machines, starters, control panels, etc., supplied under this and all other contracts except as noted herein.
- .3 Power wiring will include but not be limited to all raceways, conduits, lugs, fittings, disconnect switches, auxiliary devices for 3-phase 600 V, and 3-phase 208 V motors and 1-phase 208 V, and 1-phase 120 V motors. All wiring motor to be in accordance with the manufacturer's specifications.
- .4 The use of "lock off stop" devices will not be permitted. Provide isolation disconnect switches for all motors that are 9 m or greater away from the motor starter or if the distance is less, provide disconnect switches for the motors where the motor starter is not visible.

- .5 All two (2) speed and delta wye motors shall have an adequate number of properly sized feeders between the starters and motors to allow for operation. Note that all remote disconnect switches located adjacent to 2-speed motors and delta wye shall be 6-pole with an auxiliary contact.
- .6 All motor 25 HP or larger shall be complete with reduced voltage auto transformer starter unless otherwise noted. This is applied when starters are provided by Electrical.
- .7 All motor starters, control wiring, etc., shall conform to the Electrical Specifications.

1.38 ELEVATOR WIRING

- .1 Provide conduit, wire, fittings, disconnect switches, and auxiliary devices to wire into service the elevators as called for herein, required by the Elevator contract and as required by the Ontario Technical Safety Standards Authority (TSSA) the Electrical Safety Authority (ESA), and Ontario Building Code (OBC) and/or governing body.
- .2 The Electrical Contractor shall ensure he obtains a copy of the latest Elevator Contract documents and carry in his Price all electrical requirements specified.
- .3 For each elevator provide:
 - .1 The Electrical Contractor must request elevator shop drawings from the Contractor prior to concrete pours to ensure all requirements are met. Modifications to the installation after the fact shall not be a cost to the Departmental Representative.
 - .2 A 600 V 3-phase power service to include a protective device at the distribution point, a fusible disconnect switch at the top of the elevator shaft.
 - .3 A separate 120 V, 15 A lighting branch circuit to include a protective device at the distribution point, a fusible disconnect switch in the elevator machine room, located on the lock-jamb side of the elevator machine room entrance door, and wiring from the distribution point through the disconnect switch in the elevator machine room, and from disconnect switch to elevator controller. Provide additional fused disconnect switches for elevator cab fan and elevator cab receptacle with a separate 15A, 120V circuits. Locate fused disconnect switches beside other switches. Electrical Contractor shall coordinate with elevator contractor for exact locations prior to roughing-in.
 - .4 Provide a dedicated 120V 15A duplex receptacle in the elevator machine room supplying no other receptacles;
 - .5 Conduit and telephone cable from the telephone backboard to the terminal box complete with terminal strip in the elevator machine room; coordinate this work with telecommunication installer. Refer to Specification sections.
 - .6 Provide Conduit and wiring from each elevator group to the fire alarm panel for fire alarm system interface.
 - .7 A separate 120V 15A feed to the elevator equipment duplex or triplex controller. Locate on the lock jamb;
 - .8 Two (2) signal circuits from the each Generator Transfer System to each elevator controller. One circuit shall indicate loss of normal power. The other shall indicate forthcoming return of normal power (advance warning signal), allowing minimum 10 second delays for this signal circuit. Maintain fire rating for these signal circuits.
 - .9 Provide Conduit and wiring to signal the Elevator controller for activation of Fire Alarm devices located in Machine Rooms, Elevator shafts and Lobbies.
 - .10 Allow for provisions required for the elevator(s) designated as fire fighter.
- .4 All conduits required between hoistways and elevator machine rooms and all wiring shall be by the Electrical Contractor. Communication and security wiring and devices shall be provided by the Electrical Contractor.

1.39 CUTTING AND PATCHING

- .1 The Contractor shall employ the particular trades to do all required cutting and patching and repairing of surfaces for his work.
- .2 Supporting members of any floor, wall or the building structure shall be cut only in such a location and manner as directed by the Consultant and the Structural Consultant.
- .3 All holes and surfaces shall be repaired with the type of material removed by the tradesmen expert in the type of repair required.
- .4 Provide fire barriers around all components in holes which penetrate fire separations. The fire barrier medium provided shall make the fire separation equal to or better than the medium which was cut away. All materials shall be CSA approved and UL listed.
- .5 All floor saw-cutting and drilling required for electrical services shall be performed within the hours approved by the DEPARTMENTAL REPRESENTATIVE's Project Administration Team. Written notice must be given to the DEPARTMENTAL REPRESENTATIVE's Project Administration Team.
- .6 All openings through concrete/block/stone/brick must be core drilled. The area shall be scanned /x-rayed prior to coring. No saw cutting/chipping will be allowed. Structural Engineer shall be provided with drawings for proposed openings for approval. All costs shall be carried by Electrical Contractor.

1.40 WARRANTY

- .1 Refer to project agreement
- .2 Where warranties on certain items extend beyond one (1) year the extended warranty shall be provided.

1.41 EXCAVATION AND BACKFILL

- .1 See section 31 23 33
- .2 The Contractor shall provide and supervise all excavation and backfill required by work for this contract. The Contractor shall be responsible for bedding, providing services, and cover all excavation and backfill. All excavation and backfill shall be done prior to finish grading and shall be restored to rough grade.
- .3 All excavation and backfill work required for this contract shall be performed by an acceptable Division Contractor in accordance with Project documents. Employ the service of this Contractor as required.
- .4 All excavated materials shall be removed from site, no native backfill will be permitted. All backfill shall be granular A and B.
- .5 Provide warranty tapes over all installed services

1.42 CONCRETE WORK

- .1 The Contractor shall provide and supervise all concrete work for this Contract.
- .2 All concrete work required for this contract shall be performed by an acceptable Contractor in accordance with the Project documents concrete work.
- .3 This includes the provision of reinforcing steel, wire mesh, ties, etc.
- .4 All anchor bolts for the work of this contract shall be provided by this contract.
- .5 Concrete work shall include but not limited to:

- .1 Ductbank encasement (inside and outside the building);
- .2 Conduit encasement (inside and outside the building).
- .3 Pre-cast manhole/pull box for the work of this contract unless specifically noted.
- .4 Equipment housekeeping pads.
- .6 The Contractor shall coordinate and supervise the concrete work.
- .7 Contractor shall submit survey marked photographs of the installations underground

1.43 INTERFERENCE DRAWINGS

- .1 Provide information and cooperate with the Contractor and Mechanical Contractor for the preparation of interference drawings.
- .2 The Contractor shall be responsible to coordinate the trades in the preparation of drawings.
- .3 The Electrical Contractor shall identify a separate line item within the Progress Draw labelled as “Interference Drawings” at a minimum of 0.3% of Contract Value.
- .4 Interference drawings shall be provided to make clear the work to be installed and/or to show how it may affect other trades.
- .5 Equipment dimensions shall be based on dimensions noted on reviewed shop drawing.
- .6 Interference drawings shall be provided to scale 1:50 for but not limited to the following areas:
 - .1 All electrical rooms, typical electrical closet on each floor, the main Electrical Room and Generator Rooms.
 - .2 Main corridor Ceiling spaces.
 - .3 Level 0 service main corridors
 - .4 Additional interference drawings of other areas may be required and as requested by the Consultants.
- .7 All components shown on the interference drawings shall be shown to scale.
- .8 For equipment substitutions a complete interference set of drawings of the area affected by the revision shall be provided by the Contractors.
- .9 Interference drawings shall be provided showing both plan and sections and shall incorporate all services including electrical conduits including and over 1" (25 mm), electrical cable trays, fire alarm devices and luminaires.
- .10 The Electrical Contractor shall submit dimensioned sleeves drawings showing the location and dimension of sleeves through all floors structural walls roofs for review by the Prime and Structural Consultants.
- .11 The Electrical Contractor shall submit a plan layout showing all of the equipment to be provided and the actual weights of the equipment for review as soon as possible after Contract Award.
- .12 Installation of the Electrical work shall not proceed until interference drawings have been submitted by the Contractor to the Prime Consultant for his review. Construction Schedules shall not be impacted.
- .13 If conflicts exist between trades and new or existing services, a proposed solution shall be submitted for review by the Consultants.

1.44 CONDUIT DRAWINGS

- .1 Provide detailed conduit routing drawings for all systems.

- .2 Routing shall identify surface, recessed and below slab drawings.
- .3 In slab routings shall be submitted for Structural Consultant's review and acceptance.
- .4 Drawings shall be prepared on the Project's delivery program and scaled for 1:100 and 1:50 etc.

END OF SECTION

1 GENERAL

1.01 GENERAL

- .1 See section 02 41 16 Demolition
- .2 Co-ordinate all work with the current use of the buildings.
- .3 Maintain all electrical services to all parts of the building which are in use. Electrical Contractor shall schedule all work and inform the Departmental Representative in writing at least one week in advance for permission if power shutdown is necessary and state time(s) and duration(s) of interruptions. Contractor to consult with the Departmental Representative and determine the equipment required to be on line 24-hours per day and provide temporary services and wiring as necessary. Reschedule work accordingly when requested by the engineer.
- .4 Include cost of premium time in tender price for work during nights, weekends or other time outside normal working hours necessary to maintain all electrical services in operation.
- .5 Maintain fire protection and emergency egress lighting at all times in accordance with governing authorities rules and regulations,

1.02 SCOPE OF DEMOLITION

- .1 Work shall include for removal, relocation and reinstallation of electrical devices, feeders and equipment in the noted areas as noted on the drawings. This shall include for, but not to be limited to:
 - .1 Disconnecting, removal and reinstallation of all electrical devices, feeders, conduit and wiring to accommodate new structural work.
 - .2 Rework of conduits, wiring and cables in space associated with the areas of work. Pull back all wiring and cables to an appropriate point for re-connection or abandonment (power, voice, communication, etc.).
 - .3 Remove and reinstall all light fixtures interfering with the structural work.
 - .4 All unused wall mounted devices shall be removed by electrical contractor and make safe all wiring.
 - .5 All work and material disposal shall be done in accordance with the established schedule and general conditions.
 - .6 All services passing through the area of work, but servicing other areas of the site, shall be identified, protected and left in place, unless otherwise noted.
 - .7 All service conduits not directly associated with area lighting, small power, local systems, etc., shall be traced and identified for review by the engineer in order to determine if services are to remain or to be removed. Once Identified, the contractor shall remove those directed by the engineer.
 - .8 Remove all conduit work which is abandoned except cut flush where embedded in structure.

1.03 REMOVAL OF MATERIALS

- .1 All material to be removed shall be reviewed on site and handed over to the Departmental Representative if required, otherwise the removed materials become the property of the Electrical Contractor.
- .2 No equipment may be burned on site or sold on site.
- .3 It is the responsibility of the contractor to remove all equipment from the site.

- .4 The building structures and exteriors are to be maintained. The electrical contractor shall remove material in a manner so as to not destroy the structure or exterior.

1.04 CO-ORDINATION BETWEEN NEW AND EXISTING INSTALLATION

- .1 Check and co-ordinate all systems in the renovated area and in the new building addition, which are extended to existing systems to ensure their proper operation.
- .2 Provide interfacing components between new and existing systems as necessary for proper performance and operation.

1.05 PENETRATIONS IN EXISTING STRUCTURE

- .1 Do all cutting for the work of this Division. Before proceeding obtain Structural Engineer's approval.
- .2 Where necessary to completely penetrate existing floors, walls, ceiling, roof or structural members provide sleeve and follow Engineer's instructions.
- .3 Patching and repairing will be done by other Contractors, at the expense of this Contractor.
- .4 Where necessary to completely penetrate existing floors, the floor slab shall be x-rayed to locate existing embedded services at the expense of this Division.

1.06 SYSTEMS TO REMAIN

- .1 All services and equipment not shown on drawings shall be maintained in operation during the construction phase. This contractor shall be required to provide new conduit and wiring for all existing systems to remain so that the existing conduit and devices do not interfere with new structural work. This Contractor shall remove existing devices and reconnect to new services accordingly.
- .2 Where circuits which run into the renovated area are fed from panels outside of the area, remove wiring back to panel, make safe circuit and update panel directories.
- .3 Maintain operation of all systems outside of the renovated area which may be affected by the renovation.
- .4 Make safe all circuits back to source which have been cut or disconnected.
- .5 Any circuits which have been made inoperative as a result of this work but are not in an area to be demolished shall be reactivated at no cost to the Departmental Representative.
- .6 Trace out and catalogue all circuits within the renovated area and adjacent areas. Mark this information on a set of drawing prior to any work commencing as these circuits will be reused as part of this work as noted on the drawings or called for in the contract documents.
- .7 Provide interfacing components between new and existing systems as necessary for proper performance and operation.
- .8 Clean and test existing equipment which is to remain and equipment being reinstalled in areas being renovated for proper operation and repair as necessary before being put back into service.
- .9 Contractor to verify operation of all existing devices and report any discrepancies to the engineer prior to proceeding with the work.
- .10 Unless noted otherwise provide additional equipment of the same type and manufacture where required to supplement existing equipment.

END OF SECTION

1 GENERAL

1.01 GENERAL

- .1 Provide fire-retardant backboards for all electrical equipment mounted on all walls as noted and for data/communication equipment.
- .2 Contractor shall submit plywood shop drawings for review in accordance with 26 05 01.

2 PRODUCTS

2.01 BACKBOARDS

- .1 Construct plywood backboards from 0.76" (19 mm) thick fir plywood, good one (1) side.
- .2 Use ULC listed fire retardant backboards, and shall be stamped.
- .3 Fire retardant stamp shall be visible and legible at all times for visual inspection. Install with fire rated stamp facing out.
- .4 Plywood shall conform to CSA4-S114.
- .5 Painted boards shall not be accepted.
- .6 No drive pins shall be permitted for any electrical installation. All fasteners shall be removable.

3 EXECUTION

3.01 INSTALLATION

- .1 Construct each backboard in a rectangular shape of the size as indicated. Where no size is indicated, provide a backboard a minimum 4" (100 mm) wider and 4" (100 mm) higher than the equipment. Where more than one (1) piece of equipment is installed on the backboard, construct the backboard of a size to suit the maximum vertical and horizontal dimensions of the equipment.
- .2 Fastenings:
 - .1 Fasten each backboard to a wall or to a structure using reviewed hardware. Provide a flat washer under the head of each fastener. Recess the head of the mounting bolt where equipment, including future equipment, is to be installed.
 - .2 Use expansion shields, toggle bolts or other types of wall fastenings to suit the wall type. Align the mounting bolts with the wall studs for stud type walls.
 - .3 Install fastenings a maximum 20" (500 mm) apart in both the vertical and horizontal directions.
 - .4 When installing equipment heavier than 50 kg, fasten the equipment through the backboard directly to the wall or support structure.
 - .5 Where walls are fire rated, Contractor shall provide a stand-off assembly to mount the plywood and minimize wall penetrations. Contractor shall submit a proposal for the stand-off assembly.

END OF SECTION

1 GENERAL

1.01 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 01 and Electrical Specifications.

1.02 STANDARDS

- .1 Provide Type TECK 90 cables in accordance with CSA Standard C22.2 No. 131-14
- .2 All cables installed in return air plenum space shall be FT-6 rated.
- .3 Aluminum cable will not be accepted.

2 PRODUCTS

2.01 BUILDING WIRES

- .1 Conductors:
 - .1 Copper conductors, of the size as indicated, having a minimum conductivity of 98 percent.
 - .2 Stranded conductors for wires sizes No. 8 AWG and larger.
 - .3 Conductors shall be minimum No. 12 AWG, size conductor for maximum 2% voltage drop to the furthest outlet on a fully loaded branch circuit.
 - .4 Conductors shall be minimum No.10 AWG for home runs to panels which exceed 24 m.
- .2 Insulation: RW90 is specified. RW90 cable shall have thermosetting polyethylene insulation rated at a minimum of 600V. RWU90 cable to be provided for underground, underslab and outdoor application. Any underground area where the cable is exposed to moisture.

2.02 TYPE TECK 90 CABLE

- .1 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene insulation rated at a minimum of 600V, Type RW 90.
- .2 Inner jacket: Polyvinyl chloride inner jacket.
- .3 Armour: Interlocking aluminum armour.
- .4 Overall jacket: Thermoplastic polyvinyl chloride LFS/LGE overall jacket for fire protection and low acid gas evolution, meeting the requirements of the Vertical Tray Fire Test to CSA Standard C22.2 No. 0.3 with a maximum flow travel of 48" (1200 mm.) (Conform to FT6).
- .5 Fastenings:
 - .1 One (1) hole malleable iron straps to secure surface mounted cables.
 - .2 12 gauge galvanized steel channel type supports for two (2) or more cables at 60" (1500 mm) centers.
 - .3 1/4" (6 mm) diameter threaded rods to support the suspended channels.
- .6 Connectors:
 - .1 Watertight TECK connectors, T & B Series 10464 and 10470.
- .7 Manufacturers: Acceptable manufacturers are:
 - .1 Canada Wire and Cable Limited

- .2 Pirelli
- .3 Phillips Cables Limited

2.03 ARMOURED CABLES

- .1 AC90 Cable:
 - .1 Conductors: Copper conductors, of the sizes as indicated, having a minimum conductivity of 98%.
 - .2 Insulation: Chemically cross-linked thermosetting polyethylene insulation rated at a minimum of 600 V.
 - .3 Armour: Interlocking armour fabricated from aluminum strip. Run length revised per EVE discussion. Refer to the agreed sketch layout.
 - .4 Maximum length of AC90 shall be run 10'-0".
 - .5 Contractor to coordinate ground and neutral requirements to suit specified requirements.
 - .6 AC90 must meet specialty grounding requirements. If grounding requirements are not met the contractor shall reconsider wiring requirements and note on Supplementary Form.

2.04 CONTROL CABLES

- .1 300V/600V control cable: Stranded annealed copper conductors sized as indicated, with TWH thermoplastic insulation with a shielding of 100% coverage of aluminum polyester tape and drain wire over each group and over all conductors and an overall jacket of PVC.
- .2 300V/600V cables shall conform to latest CSA standards CAN 3-C21.2 M86 and supplements.
- .3 Custom control cables shall be designed and assembled in the configurations as indicated.
- .4 Each conductor shall be black and number coded, pairs shall be black and white and number coded.

3 EXECUTION

3.01 GENERAL

- .1 Install grounding, grounded and neutral conductors without any fuses, switches or breakers of any kind unless otherwise indicated.
- .2 Ground the grounded or neutral conductor at the source of supply as indicated and isolate the grounded or neutral conductor at all other locations.
- .3 Do not use any grounded or neutral conductors as a grounding conductor.
- .4 Do not use any grounding conductor as a grounded or neutral conductor.
- .5 Do not splice any wiring in any raceway. Make splices only at junction boxes.
- .6 Provide sufficient slack at the connection points of conductors to permit proper connections to be made.
- .7 Do not install any conductors in any raceway until the raceway is complete and cleared of all obstructions. Contractor shall blow all lines.
- .8 Install all conductors in any one (1) conduit at the same time taking care not to twist the conductors.
- .9 Use wire pulling lubricants that will not shorten the life of the insulation.

- .10 Do not install any wires or cables at temperatures above or below those which will cause damage to the wires or cables.

3.02 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34
 - .2 In cable-trays in accordance with Section 26 05 36.
 - .3 In underground ducts in accordance with Section 26 05 41 and 26 05 42.
 - .4 In surface and lighting fixture raceways in accordance with Section 26 05 30.

3.03 INSTALLATION OF TECK 90 1000 V

- .1 Install cables as indicated.
- .2 Group cables wherever possible on channels.
- .3 Lay cable in cable-trays in accordance with Section 26 05 36.
- .4 Terminate cables in accordance with Section 26 05 20.

3.04 INSTALLATION OF ARMOURED CABLE

- .1 Group cables wherever possible.
- .2 Lay cable in cable-trays in accordance with Section 26 05 36.
- .3 Terminate cables in accordance with Section 26 05 20.
- .4 Coordinate neutral and grounding requirements.

3.05 INSTALLATION OF MINERAL INSULATED CABLE

- .1 Install cable in trenches in accordance with Section 26 05 41.
- .2 Install cable exposed, as indicated securely supported by straps.
- .3 Make cable terminations by using factory-made kits.
- .4 At cable terminations use thermoplastic sleeving over bare conductors.
- .5 Install cable in cable-trays in accordance with Section 26 05 36.
- .6 Where cables are embedded in cast concrete or masonry, provide a sleeve for the entry or exit of cables.
- .7 Do not splice the cables.
- .8 Provide cable to maintain protection of life safety circuits.

3.06 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit or in cable-trays.
- .2 Ground individual pair control cable shields at the supply and only unless otherwise indicated.
- .3 Ground the overall control cable shields at both ends.
- .4 Reference Mechanical/Electrical Division of Responsibility.

3.07 INSTALLATION OF SECURITY AND FIRE ALARM CABLES

- .1 Install cables in accordance to Section 28 00 00.

END OF SECTION

1 GENERAL

NIL

2 PRODUCTS

2.01 MATERIALS

- .1 Provide pressure type wire connectors with current carrying parts of copper sized to fit copper conductors as required.
- .2 Provide fixture type splicing connectors with current carrying parts of copper sized to fit copper conductors No. 10 AWG or less.
- .3 Provide bushing stud connectors in accordance with EEMAC 1Y-2-1961 to consist of:
 - .1 A connector body and a stud clamp for stranded copper conductors.
 - .2 A clamp for stranded copper conductors
 - .3 Stud clamp bolts as required.
 - .4 Bolts for the copper conductors.
 - .5 Sized for the conductors as indicated.
- .4 Provide clamps or connectors for the armoured cable, flexible conduit, as required.

3 EXECUTION

3.01 INSTALLATION

- .1 Remove the insulation carefully from the ends of the conductors and:
 - .1 Apply a coat of zinc joint compound on the aluminum conductors prior to the installation of the connectors;
 - .2 Install the mechanical pressure type connectors and tighten the screws with an appropriate compression tool recommended by the manufacturer. The installation must meet the secureness tests in accordance with CSA C22.2 No. 65-13;
 - .3 Install the bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

1 GENERAL

1.01 Standards

- .1 Provide the grounding in accordance with good industry practice and in accordance with the following Standards:
 - .1 CSA Standard C22.2 No. 41 - Grounding and Bonding Equipment.
 - .2 Local authority having jurisdiction and ESA.

2 PRODUCTS

2.01 Material

- .1 Provide grounding clamps for grounding conductors, of the sizes as required, on all electrically conductive underground water pipes, T & B 3902 series.
- .2 Provide systems circuit grounding conductors and equipment grounding conductors of bare stranded copper, soft annealed, of the sizes as indicated.
- .3 Provide a green RW90 insulated grounding conductors of the sizes as indicated. UPS grounding conductor shall be green with a yellow line the full length of the conductor. The conductor shall be RW90/RWU90 size as noted.
- .4 Provide copper ground bus bars 0.24" x 2" (6 mm x 50 mm) complete with insulated supports, fastenings and connectors. Length and routing of ground bus shall be as indicated on the drawings.
- .5 Provide all non-corroding accessories necessary for the grounding system of the type, size and 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 and straps;
 - .6 Compression wire connectors.

3 EXECUTION

3.01 Installation General

- .1 Install a complete, permanent and continuous systems circuit grounding system and an equipment grounding system including electrodes, conductors, connectors, accessories as indicated to conform to the requirements of these specifications and the local authority having jurisdiction over the installation.
- .2 Install the connectors in accordance with the manufacturer's instructions.
- .3 Protect all exposed grounding conductors from mechanical injury.
- .4 Make buried connections and connections to conductive water mains and electrodes using a thermit copper welding process or compression type connectors.
- .5 Use compression connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints are not permitted.

- .7 Install an insulated bonding conductor inside each flexible conduit, flexible liquidtight conduit and conduit run with an expansion joint with the conductor connected at both ends to grounding. Provide RWU90 and RW90 types to suit conduit.
- .8 Install flexible ground straps, where such bonding is not inherently provided with equipment, for the following:
 - .1 Cabletrough joints; cable tray and raceways.
 - .2 Cabletrough expansion joints.
- .9 Install a separate grounding conductor in the following:
 - .1 All EMT/ENT conduit runs;
 - .2 All PVC conduit runs;
 - .3 All underground or underslab runs;
 - .4 All direct buried runs. Provide *tracer* wire prior to backfilling #10 std. White.
 - .5 Cable tray, if applicable
- .10 Connect the building structural steel and metal siding to ground.
- .11 Make the grounding connections in a radial configuration only with the connections terminating at a single grounding point at the street side of the water meter. Do not make loop connections except as indicated.
- .12 Bond single conductor, metallic armoured cables to the cabinet at the supply end, and provide a non-magnetic entry plate at the load end and at the load end.
- .13 Provide a grounding system with a maximum resistance to ground of 5 ohms.

3.02 System And Circuit Grounding

- .1 Install system and circuit grounding connections to the neutral of the primary 600V system, secondary 120/208V system.

3.03 Equipment Grounding

- .1 Install grounding connections from the exposed, non- current carrying metal parts of equipment included in but not necessarily limited to following:
 - .1 Service equipment;
 - .2 Transformers;
 - .3 Switchgear;
 - .4 Duct systems;
 - .5 Frames of motors;
 - .6 Motor control centres;
 - .7 Starters;
 - .8 Control panels;
 - .9 Building steel work;
 - .10 Generators;
 - .11 Elevators;
 - .12 Distribution panels;
 - .13 Outdoor lighting;
 - .14 Gas line(s);
 - .15 Water piping;
 - .16 Door frames where indicated;
 - .17 Cable tray, if applicable;

3.04 Grounding Bus

- .1 Install a copper grounding Bus Bar on the walls of the Electrical Room per the documents.

- .2 Ground all items of electrical equipment in the electrical room to the ground bus with individual No. 3/0 AWG bare stranded copper connections unless otherwise indicated.

3.05 Communication Systems

- .1 Install grounding connections for life safety and all other systems, minimum #6 insulated ground wires.

3.06 Grounding Data/Voice Communication:

- .1 Refer to Section 27 00 00 and documents.

3.07 Grounding of Audio/Visual System:

- .1 Provide one (1) #6 insulated ground wire from main electrical room ground bus to each Audio/Visual closet(s)

3.08 Grounding of Security System

- .1 Refer to Section 28 00 00 and documents.

3.09 Grounding of Cable TV System

- .1 Provide one (1) #6 insulated ground wire from the main electrical room ground to cable TV cabinet, or to suit local provider.

END OF SECTION

1 GENERAL

1.01 RELATED WORK

- .1 Electrical Specifications in its entirety.

2 PRODUCT

2.01 SUPPORT CHANNELS

- .1 U-shaped, steel channel, accurately cold rolled formed from 12 gauge, low carbon steel with finished dimensions of 3.1 mm x 3.1 mm, intumed clamping ridges and a continuous slot along one (1) side for the insertion of slotted nuts. Hot dip galvanize the channel after fabrication with a zinc weight of 1.5 oz/ft sq.
- .2 Nuts with 2 serrated grooves to engage the clamping ridges of the channel, a spring to hold the nut in place during installation and threaded with Unified and American course threads. Case harden and electrogalvanize after fabrication.
- .3 Electrogalvanized bolts, threaded rod, flat and lockwashers as required.
- .4 Angle, U, Z and special fittings, brackets, bases, clamps, hangers, couplings and other fittings as required and galvanized unless otherwise indicated.
 - .1
- .5 All support channel supports are to be safe and installed to prevent injury. Including support screws.

2.02 CONCRETE ANCHORS

- .1 Drilled expansion anchors for anchors set in concrete block or poured concrete after the concrete has set. Size the insert and number of anchors so that the maximum load per anchor does not exceed 25% of the manufacturer's published maximum loading.
- .2 Provide concrete anchors of one (1) manufacturer.
- .3 U-channel concrete inserts shall be 12 gauge steel 41mm square with insert anchors 35mm long and 25 mm on centre

3 EXECUTION

3.01 INSTALLATION

- .1 Secure equipment to masonry, tile and plaster surfaces with lead anchor, drive pin anchors are not permitted.
- .2 Secure equipment and concrete inserts to poured concrete with expansion anchors.
- .3 Secure equipment to suspended ceilings with toggle bolts.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to the basic channel members.
- .5 Fasten exposed conduit or cables to the building construction or support system using straps:
 - .1 1-hole steel straps to secure surface conduits and cables 50 mm and smaller;

- .2 2-hole steel straps for conduits and cables larger than 50 mm;
- .3 beam clamps to secure the conduit to the exposed steel work.
- .6 Suspended Support Systems:
 - .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
 - .2 Support two (2) or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to the building construction is impractical.
- .7 Use channels at a maximum 3m centres for surface mounting of two (2) or more conduits.
- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support the conduit and cable runs.
- .9 Provide 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 the permission of Consultant.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with the manufacturer's installation recommendations.

END OF SECTION

1 GENERAL

1.01 REFERENCE

- .1 Electrical General Provisions.

1.02 RELATED WORK

- .1 Conduits, Conduit Fastenings and Fittings.
- .2 Concrete Encased Ductbanks.
- .3 Wires and Cables up to 1000V.
- .4 Outlet Boxes, Conduit Boxes and Fittings.
- .5 Wire and Box Connectors up to 1000V.
- .6 Secondary Distribution.
- .7 Fire Alarm System.

2 PRODUCTS

NIL

3 EXECUTION

3.01 GENERAL

- .1 General: All wiring shall be recessed when located in finished areas. Surface mounted wiring may be used in mechanical rooms, service spaces or as noted. Provide protection to conduits which may be subject to mechanical damage.
- .2 All wires including neutrals and grounds shall be labeled at both ends (tagged).
- .3 Branch Medium Voltage Feeders: wire in conduits.
- .4 Main 600/347V and 120/208 V, 3 Phase Wire Distribution:
 - .1 Type RW90 in conduits; busways, etc. above grade.
 - .2 Where fire rated cable is required the conduit is to be surrounded in fire resistant casing to meet circuit integrity and building code requirements or a suitably rated cabling system shall be used (MI cable).
 - .3 Main mechanical systems feed - wire in conduit; busways, etc.
 - .4 All other feeders as detailed on drawings; wire in conduit.
 - .5 Provide applicable insulation for the environment the feeder(s) shall be installed. i.e. use RWU90 for underground, in-ground, under slab on grade, exterior etc. any location where cables are exposed to moisture.
- .5 General power and lighting distribution: Wire in conduit.
 - .1 Branch circuit wiring within drywall partitions; wire in conduit.
 - .2 Final drops to luminaries with limited length (3 m max) may be made with Type AC90 cable or wire in conduit;
 - .3 All other power and distribution shall be wire in conduit;
- .6 Fixture Wiring: Flexible wiring systems for all recessed ceiling mounted fixtures (all other are wire in conduit).

- .7 Fire Alarm System:
 - .1 Wire in conduits to maintain and ensure code fire rating.
 - .2 Flexible watertight connections to supervised valves, pressure switches, flow switches, smoke dampers, etc.
- .8 Telephone and Data Communication Systems:
 - .1 Two pullstrings and wire in conduit.
 - .2 Size of conduits for drops as noted.
- .9 Motor and Control Wiring:
 - .1 Wire in conduit;
 - .2 Flexible sealtite connection shall be made between all non flexible conduit assemblies and vibrating parts (e.g. between motors and conduits).with a 180° loop and watertight connections.
 - .3 To suit acoustic requirements (if applicable) Coordinate with Architect.
- .10 Security Systems:
 - .1 Two pullstrings and wire in conduit.
 - .2 Size of conduits as noted.
- .11 Occupancy Sensors: Wire in conduit.
- .12 Site Lighting: Wire in rigid PVC conduit. Refer to plans.

END OF SECTION

1 GENERAL

1.01 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data for cabinets in accordance with Section 26 05 01.
- .2 Nameplates.

2 PRODUCTS

2.01 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Mains, branch lugs, and connection bars to match required size and number of incoming and outgoing conductors as indicated.
- .3 Provide at least three (3) spare terminals on each set of lugs in all splitters.
- .4 Splitter to be to CAN/CSA C22.2 No. 76.-M92 (R2012)

2.02 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 Junction boxes and pull boxes to be to CSA C22.2 No. 40-M1989 (R2014).
- .4 NEMA rating to suit environment.

2.03 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 19 mm fire rated plywood backboard for flush mounting in finished areas and surface mounting in service and mechanical spaces.

3 EXECUTION

3.01 SPLITTER INSTALLATION

- .1 Install splitters as indicated and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.02 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2000 mm above finished floor.
- .3 Install terminal block as required in Type T cabinets.
- .4 Drawings do not show all junction and pull boxes. Those shown are diagrammatic only. Provide junction boxes and pull boxes as required by Code.

3.03 IDENTIFICATION

- .1 Provide equipment identification in accordance with Electrical Specifications.
- .2 Install identification labels indicating system name and voltage and phase. Refer Nameplate Specification section.
- .3 Label/paint boxes per specifications.

END OF SECTION

1 GENERAL

1.01 PRODUCT DATA

- .1 Submit product data in accordance with Section 26 05 01.
- .2 Reference Structural and Architectural Documents.

2 PRODUCTS

2.01 OUTLET AND CONDUIT BOXES GENERAL

- .1 All boxes shall have pre-punched 19 mm knockouts. Provide a 25mm knockout to suit telecom.
- .2 Do not use boxes with cable clamps.
- .3 Provide 100 mm square or larger outlet boxes as required for special devices.
- .4 Provide gang boxes where wiring devices are grouped.
- .5 Provide deep masonry boxes (MBS Series) for data communications outlets in dry wall partitions, complete with the required support brackets and clips.
- .6 Provide combination boxes with barriers where outlets for more than one (1) system are grouped. Combination boxes shall be multi-ganged shallow masonry box (MBS Series), complete with barrier and the required support brackets and clips.
- .7 Outlet boxes, conduit boxes and fittings to be to CSA C22.2 No. 18.2-06
- .8 Provide blank cover plates for boxes without wiring devices and label as "Future" Interior of box shall note the respective system by paint and label on the interior and on the coverplate.

2.02 SHEET STEEL OUTLET BOXES

- .1 Provide single and multigang electro-galvanized steel flush device boxes as required for flush installation, minimum size 76 mm x 50 mm x 38 mm or as required. Provide 100 mm GSB Series outlet boxes when more than one (1) conduit enters one (1) side. Add extension and plaster rings as required.
- .2 Provide 100 mm square or octagonal outlet boxes for luminaire outlets.
- .3 Provide 100 mm square outlet boxes with extension and plaster rings for flush mounted devices to suit wall finish, as required.

2.03 MASONRY BOXES

- .1 Provide single and multigang electro-galvanized steel masonry boxes as required for devices flush mounted in concrete block walls.
- .2 Electrical Contractor shall confirm prior to installation with Prime Consultant where box and coverplate meet with motor joints.

2.04 CONCRETE BOXES

- .1 Provide deep cast iron concrete type boxes for flush mount in concrete with matching extension and plaster rings as required. Boxes to be installed in concrete shall be approved for this purpose. Refer to Wiring Device section.

2.05 CONDUIT BOXES

- .1 Provide cast FS or FD aluminum boxes with factory- threaded hubs and mounting feet for the surface wiring of switches and receptacles as required.

2.06 PVC BOXES

- .1 All PVC boxes to have approved ground straps and shall be compatible with PVC conduit used.

2.07 FITTINGS - GENERAL

- .1 Provide bushing and connectors with nylon insulated throats.
- .2 Provide knock-out fillers to close unused knock-outs.
- .3 Provide conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Acoustic isolation pads to be Acoustiguard putty pads or equivalent.

3 EXECUTION

3.01 INSTALLATION

- .1 Provide acoustic isolation pad around electrical boxes in walls surrounding clinical spaces. Isolation pads to be installed in accordance with manufacturer's directions. Isolation pad to Kinetics IsoBacker or similar device to achieve an equal or better sound attenuation.
- .2 Back to back recepticals and other devices on both sides of walls surrounding clinical spaces shall be offset by a minimum of 150mm.
- .3 Support all boxes independently of the connecting conduits. All boxes to be hung independently of ducts, pipes, etc.
- .4 Fill boxes with sponges or foam or similar approved material to prevent the entry of foreign material during construction.
- .5 For flush wall installations, mount the outlet boxes flush with the finished walls using plaster rings to permit the wall finish to come within 6 mm of opening. Coordinate with Architectural drawings for wall construction and provide extender ring (s) to suit.
- .6 Provide the correct size of openings in the boxes for the conduit, and armoured cable connections. Reducing washers are not permitted.
- .7 When using rigid PVC conduit, use approved boxes.
- .8 For boxes mounted with in split-face block walls, the electrical contractor shall carry the cost of The Mason Contractor to grind the block so as the box and coverplate sit flush. Both contractors shall provide a mock-up for the Prime Consultant for review.

END OF SECTION

1 GENERAL

1.01 REFERENCE

- .1 Electrical General Provisions.
- .2 Wiring Methods.

1.02 LOCATION OF CONDUIT

- .1 The drawings do not show all conduits. Those shown are in diagrammatic form only, but show the general intent. The Electrical Contractor shall provide detailed routing drawings for coordination.
- .2 Conduits are to be provided to create complete raceway systems.
- .3 Refer to structural drawings for the extent of hollow-core slabs (if applicable). Openings through hollow core slabs shall be limited and must be approved by structural engineer.
- .4 Prior to any installation of recessed conduits in the slab, the contractor shall submit the proposed routes to the structural engineer for approval prior to installation. All conduit sizes to be labeled. Failure to submit conduit routing layouts prior to installation may result in the removal of conduits at the cost of both the General and Electrical Contractors.

1.03 NUMBER AND SIZES OF CONDUITS

- .1 Conduits to be provided shall be as indicated in documents and/or as required to suit requirements of systems installed as specifically noted within this specifications.

2 PRODUCTS

2.01 CONDUITS

- .1 Rigid, Schedule 40, galvanized steel threaded conduit of the size as indicated and required to CSA C22.2 No. 45.-M1981 (R2003)
- .2 Electrical metallic tubing (EMT) of the sizes indicated and required to CSA C22.2 No. 83.-M1985 (R2013)
- .3 Rigid Schedule 40 PVC conduit of the sizes indicated and required to CSA C22.2 No.137.3
- .4 Flexible liquid-tight flexible steel conduit of the sizes indicated and required to CSA C22.2 No. 56-13.
- .5 Contractor shall not use conduits smaller than 19 mm unless specifically noted.

2.02 CONDUIT FASTENINGS

- .1 One (1) hole malleable iron, hot dipped galvanized straps to secure surface mounted conduits. Thomas & Betts Series 1275 for rigid, threaded conduit and Thomas & Betts Series 4175 for EMT complete with properly sized flat head screw.
- .2 Beam clamps to secure conduits to exposed steel members.
- .3 Provide 41mm x 41mm galvanized steel channel type supports for two (2) or more conduits on a minimum 1500 mm centres. Use suitable conduit clamps in channel.

- .4 Provide 6 mm dia. threaded rods to support the suspended channels.

2.03 CONDUIT FITTINGS

- .1 Fittings manufactured for use with the conduit specified with the same coating as conduit.
- .2 Provide insulated bushings on all rigid, threaded conduits.
- .3 Provide steel set screw concrete-tight connectors and couplings for EMT conduits. Thomas & Betts TC-7 Series and TK-12 Series, diecast fittings are not permitted.
- .4 Provide steel couplings and connectors for all EMT conduits, Thomas & Betts Series 5123, and 5120.
- .5 Provide double locknuts and a nylon insulated bushing for Schedule 40 conduit connections to sheet steel boxes and enclosures.
- .6 Rain tight, steel fittings shall be used for all DEPARTMENTAL REPRESENTATIVE security conduit and backbox installations.
- .7 Rain tight, steel fitting shall be used on all surface mounted conduits and equipment with or without the area being sprinklered. "O" rings shall be used where all connectors penetrate any surface mounted equipment or back boxes, including but not limited to switchgear, panelboards, etc.

2.04 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with an integral bonding assembly suitable for a 100 mm linear expansion.
- .2 Watertight expansion fittings with an integral bonding jumper suitable for linear expansion and a 20 mm deflection in all directions.

2.05 EXPLOSION PROOF CONDUIT FITTINGS

- .1 EYS Series fittings complete with Chico X Fire Dam and Chico 'A' sealing compound.

2.06 FISH CORD

- .1 Fish lines to be standard industry practice for the size of conduit and cable pulling requirements.

3 EXECUTION

3.01 INSTALLATION

- .1 Install all conduits to conserve headroom in exposed locations and to cause minimum interference in the spaces through which they pass.
- .2 Conceal all conduits except in unfinished areas unless otherwise indicated.
- .3 Do not surface mount conduits on building exterior surfaces unless otherwise indicated or approved by Prime Consultant.
- .4 All equipment boxes and conduit on columns to be recessed.
- .5 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .6 Mechanically bend steel conduit over 19 mm dia.

- .7 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .8 Install fish cord in all conduits.
- .9 Run four (4) 25 mm spare conduits up to ceiling space and four (4) 25 mm spare conduits down to accessible ceiling space from each recess mounted panel. Terminate these conduits in 305 mm x 305 mm junction box respectively. Identify the junction box and label. Pack and seal penetrations to maintain fire ratings.
- .10 Where conduits become blocked, remove and replace blocked section.
- .11 Dry conduits out before installing wire.
- .12 Do not fasten conduits to metal roof decks.
- .13 Use rigid, threaded Schedule 40, galvanized steel threaded conduit except where specified otherwise.
- .14 Use rigid PVC for conduit for underground and in slab installations.
- .15 Use electrical metallic tubing (EMT) in all areas, unless specifically noted and not subject to mechanical injury. EMT shall not be used under slab or in slab.
- .16 Use liquid tight flexible conduit for connections to motors, connections for all exterior light fixtures, connections for all exterior systems, connection to recessed incandescent fixtures without a pre-wired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.
- .17 Use liquid tight flexible metal conduit for connection to motors, transformers etc.
- .18 Refer to conduit requirements of other specific sections of this specification which may include Data/Communication, and security.

3.02 PVC CONDUITS

- .1 PVC conduits may be bent in the field using approved electrical heating devices or by using the appropriate bends. Damaged or improper bends shall be replaced. All joints shall be made using an approved coupling with solvent welds. Clean all joints with solvent cleaner prior to applying the solvent. Liberally apply the solvent to the conduit fitting, force the conduit into the fitting and rotate the conduit 45 degrees within the flange to form a tight bond. Allow proper curing time.
- .2 All scorched PVC conduit shall be removed immediately.
- .3 Rigid PVC conduits shall be used for only underslab or grade or in slab runs. Rigid PVC conduits shall not be used in block or steel stud wall construction. Maximum size of conduit to run in slab is noted in this section, larger conduits shall be installed under slab. All PVC conduits shall transition to rigid galvanized conduit when exiting slabs, floors, walls or ceilings. Exposed PVC is not acceptable.

3.03 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended channels provided accepted by Structural Consultant.
- .5 Do not pass conduits through structural members except as permitted by Structural Consultant.

- .6 Do not locate conduits less than 50 mm parallel to steam or hot water lines with a minimum of 25 mm at crossovers.

3.04 CONCEALED CONDUITS

- .1 Do not install horizontal runs in masonry or partition walls.
- .2 Do not install conduits in terrazzo or concrete toppings.

3.05 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Do not install conduits in Cast-In-Place concrete unless approved by the Departmental Representative and structural engineer.

3.06 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Do not install conduits in Cast-In-Place slabs on grade unless approved by the Departmental Representative and structural engineer.

3.07 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.
- .3 All conduits in-slab 38 mm or greater shall be approved by the Structural Engineer prior to installation. Electrical Contractor shall submit conduit routing drawings for approval.

3.08 EXTERIOR

- .1 All conduits to run to site security lighting and receptacles, etc., located on the below grade shall be PVC. RGS conduits and boxes shall be provided above grade.
- .2 All conduit runs to light standards shall be rigid PVC conduit or polyethylene. Minimum size of PVC conduit is 25mm in diameter.
- .3 Provide minimum 1 m cover on all conduits feeding site lighting. Locate fluorescent plastic strip tape 500 mm above feeders. Provide a 100 mm envelope of granular 'B' fill around feeder and backfill with native materials.

3.09 HAZARDOUS LOCATIONS

- .1 All conduit runs in hazardous locations if exposed to the environment shall be rigid galvanized steel.

3.10 LOCATION OF CONDUITS

- .1 Care must be taken to indicate the routes and the placements in which conduits can be located as the majority of conduits are exposed/surface mounted and must be reviewed by the Architect.
- .2 Locations, radius and numbers with dimensions indicate all conduits related to gridlines.
- .3 Installation of conduits of slab on grade, and/or in slabs shall confirm to structural requirements. Routes must be submitted to Structural Consultant for review.
- .4 Where conduits and boxes embedded in concrete slabs and walls, and the slabs and walls shall be finished with insulation, acoustical panels, etc. Extension boxes shall be installed to

bring the devices to the same finished surface. Electrical Contractor shall review architectural drawings prior to Price Submission.

END OF SECTION

1 GENERAL

1.01 RELATED WORK

- .1 Electrical General Provisions.
- .2 Excavation and Backfilling.
- .3 Authority Having Jurisdiction Specifications
- .4 Electrical Specifications in its entirety.
- .5 Commissioning Agent inspection team.

2 PRODUCTS

NIL

3 EXECUTION

3.01 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.
- .8 Provide pulling eyes in main Electrical Rooms as required to ease the cable installation and protect the cables. Coordinate the pulling eye installation with Structural Consultant, rebar installation and concrete pour schedule.

3.02 MARKERS

- .1 Mark cable every 50 m along duct runs and changes in direction.
- .2 Where markers are removed to permit installation of additional cables, reinstall the markers.
- .3 Lay concrete markers flat and centered over cable.

3.03 TESTING

- .1 Perform tests in accordance with Electrical Specifications and Commissioning section.
- .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.

-
- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
 - .5 Pre-acceptance tests.
 - .1 After installing cable(s) but before splicing and terminating, the Contractor shall perform insulation resistance test with 1000V megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
 - .3 Replace all damaged cables.
 - .6 Acceptance Tests
 - .1 Ensure that terminations and accessory equipment is disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .7 Conduct hipot testing in accordance with IPCEA recommendations.
 - .8 Provide the Consultant and OWNER's Project Administration the test results showing the location at which each test was made, circuit tested and result of each test.
 - .9 Remove and replace entire length of cable if the cable fails to meet any of the test criteria.

END OF SECTION

1 GENERAL

1.01 RELATED WORK

- .1 Electrical General Provisions including Excavation and Backfilling.
- .2 Division 03

2 PRODUCTS

2.01 SAND BEDDING

- .1 Sand bedding shall conform to OPSS 1004.

2.02 UNSHRINKABLE BACKFILL

- .1 Unshrinkable backfill shall conform to Contract documents.

2.03 DUCTS FOR UTILITY, TELEPHONE AND COMMUNICATION SERVICE CABLES

- .1 Rigid PVC ducts, Type DB2: CSA C22.2 No. 211.1-2006 (R2011).

2.04 DUCTS FOR POWER / LIGHTING CABLES

- .1 Rigid PVC conduits: CSA C22.2 No. 211.2-2006 (R2011), direct buried. Core line duct type is not acceptable.

2.05 PVC DUCT FITTINGS

- .1 Provide rigid PVC couplings, bell end fittings, plugs, caps, adaptors as required to make complete installation. Pushfit type fittings will be acceptable for concrete encased ducts only.
- .2 Provide expansion joints as required.
- .3 Provide rigid PVC 5° angle couplings as required.
- .4 Rigid PVC 90° and 45° sweep bends as required.

2.06 SOLVENT WELD COMPOUND

- .1 Provide solvent weld compound for PVC duct joints.

2.07 CABLE RACKS

- .1 Provide hot dipped galvanized cable racks and supports to suit cable requirements.
- .2 12 mm x 100 mm preset inserts for rack mounting within slab construction.

2.08 CABLE PULLING EQUIPMENT

- .1 Provide pulling eyes made of galvanized steel rods, size and shape to suit cable requirements.

- .2 Provide polypropylene pull rope tensile strength 5 kN (1000 lbs) continuous throughout each duct run with 3000 mm spare rope at each end.

2.09 MARKERS

- .1 Provide concrete type duct markers, with arrows to indicate change in direction of duct runs.

3 EXECUTION

3.01 INSTALLATION GENERAL

- .1 Provide direct buried ducts as indicated on drawings, or as required.
- .2 Protect existing cables and equipment when coring into existing manholes or structures alike.
- .3 Clean and pull stiff bristle brush through each duct immediately before pulling-in cables.

3.02 TRENCHING AND BEDDING

- .1 Open trench completely before ducts are laid to ensure that no obstructions will necessitate change in grade of ducts.
- .2 Prior to laying ducts, uniformly grade the undisturbed earth at the bottom of trench free of sharp stones or rock fragments. Where unstable earth is encountered, remove earth and replace with granular 'B' not less than 150 mm thick, compacted to 95% of maximum proctor dry density.
- .3 Provide sand bedding of thickness not less than 75 mm for direct buried ducts.

3.03 DUCT INSTALLATION

- .1 Install ducts at elevations with minimum slope of 1 to 400, or otherwise indicated, such that a water trap will not be created within the duct system.
- .2 Install base spacers at maximum intervals of 1500 mm parallel to grade at the bottom of each layer of ducts. Adjust trench bottom for spacers to seat firmly and locate spacers at each duct bend transition.
- .3 Lay ducts in accordance with the specified configuration. Install rigid PVC intermediate spacers to maintain spacing between ducts at not less than 40 mm horizontally and vertically.
- .4 Stagger joints in adjacent layers at least 150mm and make joints watertight.
- .5 Embed ducts with sand.
- .6 Make transpositions, offsets and changes in direction using 5° bend sections, do not exceed a total of 20° with duct offset.
- .7 Tracer Wire: All electrical installations, including but not limited to conduits, duct cables shall be installed with a tracer wire along side of the installation. Tracer wire shall be turned up at both ends. Tracer wires shall be encased with all duct banks, direct cables or piping for electrical or mechanical. Tracer wire shall be #10 copper, white stranded and continuous. No underground connections/splices shall be permitted.

3.04 DUCT TERMINATION

- .1 Use bell ends at all duct terminations.

- .2 Use conduit to duct adapters of appropriate sizes when connecting to conduits.
- .3 Terminate duct runs with a duct coupling when dead ending duct bank for future extension.
- .4 Cut, ream and taper end of ducts in field in accordance with manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.
- .5 Clean ducts before laying.
- .6 Cap and seal the ends of ducts during construction and after installation to prevent entrance of foreign materials.

3.05 SAND ENCASEMENT

- .1 Use anchors, ties and trench jacks as required to secure ducts and prevent moving during pouring of sand. Tie ducts to spacers with twine or other non-metallic material. Remove weights or wood braces before sand fills voids.
- .2 Photograph installation and submit to DEPARTMENTAL REPRESENTATIVE and include in manuals cross referencing Record Drawings.
- .3 Provide sand embedment to fill all voids.
- .4 Immediately after placement of sand, pull through each duct a steel mandrel not less than 300 mm long and of a diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter.

3.06 BACKFILLING

- .1 Unless otherwise specified to use unshrinkable backfilling, backfill with granular 'A' for driveways, native materials free of stones or rock fragments larger than 50 mm in diameter for the remaining areas, and compact to 95% of Standard Proctor Density.

3.07 RESTORATION

- .1 Where not covered elsewhere in the contract, restore the grade finish to match existing.

3.08 MARKERS

- .1 Provide a continuous marker warning tape located 500 mm above the ductbank. Lay the marker flat and centered over ductbank.

3.09 INSPECTIONS

- .1 Schedule and notify the General Contractor and Consultant one week in advance in writing to inspect ducts prior to backfilling and be present during clean-out.
- .2 Provide digital photographs for both the manuals and cross-reference the photograph locations on the as built drawings.

END OF SECTION

1 GENERAL

1.01 RELATED WORK

- .1 Electrical General Provisions.
- .2 Excavation and Backfilling.
- .3 Authority Having Jurisdiction Specifications
- .4 Electrical Specifications in its entirety.
- .5 Commissioning Agent inspection team.

2 PRODUCTS

2.01 GENERAL

- .1 The following items are provided for Base Reference only. All materials and method of installation must conform to authority having jurisdiction, Departmental Representative Standards and Electrical Specifications.

2.02 MATERIALS

- .1 PVC underground telecommunication cable ducting: to CSA B196.3-M1983 (R2011)
- .2 PVC underground power cable ducting: to CSA B196.1-1972.

2.03 PVC DUCTS

- .1 PVC ducts, Type DB2, encased in reinforced concrete, size as indicated.

2.04 PVC DUCT FITTINGS

- .1 Rigid PVC opaque solvent welded type couplings, bell end fittings, plugs, caps, adaptors as required to make complete installation.
- .2 Expansion joints as indicated.
- .3 Rigid PVC 5° angle couplings as indicated.

2.05 CABLE PULLING EQUIPMENT

- .1 Provide pulling iron (eye) made of galvanized steel rods, size and shape to suitable requirements.
- .2 6 mm stranded polypropylene MHD bare pull rope tensile strength 5 kn continuous throughout each duct run with 3000 mm spare rope at each end.

2.06 MARKERS

- .1 Provide duct markers (warning strips) as indicated, with arrows to indicate change in direction of duct runs.

3 EXECUTION

3.01 DUCTBANK INSTALLATION

- .1 Install reinforced concrete encased underground duct banks, including formwork.
- .2 Build duct bank and manholes on undisturbed soil or on well compacted granular fill not less than 150 mm thick, compacted to 95% of maximum proctor dry density.
- .3 Open trench completely between manholes to be connected before ducts are laid and ensure that no obstructions will necessitate change in grade of ducts.
- .4 Install ducts at elevations and with slope as indicated and minimum slope of 1 to 400.
- .5 Install base spacers at maximum intervals of 1500 mm leveled to grades indicated for bottom layer of ducts.
- .6 Lay ducts with configuration and reinforcing as indicated with preformed interlocking, rigid plastic intermediate spacers to maintain spacing between ducts at not less than 75 mm horizontally and vertically. Stagger joints in adjacent layers at least 150 mm and make joints watertight. Encase duct bank with thick concrete cover. Use galvanized steel conduit for sections extending above finished grade level.
- .7 Make transpositions, offsets and changes in direction using 5° bend sections, do not exceed a total of 20° with duct offset.
- .8 Use bell ends at duct terminations in manholes or entry rooms.
- .9 Use conduit to duct adapters when connecting to conduits.
- .10 Terminate duct runs with a duct coupling set flush with the end of the concrete envelope when dead ending duct bank for future extension, extend and arrange rebar to accept the future extension.
- .11 Cut, ream and taper end of ducts in field in accordance with manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.
- .12 As a minimum allow the concrete to attain 50% of its specified strength before backfilling. Confirm with Structural Engineer.
- .13 Use anchors, ties and trench jacks as required to secure ducts and prevent moving during pouring of concrete. Tie ducts to spacers with twine or other non-metallic material. Remove weights or wood braces before concrete has set and fill voids.
- .14 Clean ducts before laying. Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.
- .15 Immediately after placing of concrete, pull through each duct a steel mandrel of a diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely. Pull stiff bristle brush through each duct immediately before pulling-in cables. Contact Departmental Representative Facility and Consultant on-site forces for inspections.
- .16 Install four 3000 mm lengths of 15M reinforcing rods, one in each corner of duct bank when connecting duct to manholes or buildings. Wire rods to 15M dowels at manhole or building and support from duct spacers.
- .17 Protect existing cables and equipment when breaking into existing manholes. Place concrete down sides of duct bank filling space under and around ducts. Rod concrete with flat bar between vertical rows filling voids. Coordinate tie-in with Structural Engineer prior to rebar.

- .18 For ductbanks that are to be continued by another contract. This Electrical Contractor shall coordinate and provide all necessary rebar and duct extensions to accommodate the continuation.
- .19 All underground conduits and piping are to be installed with a tracer wire along side of the installation. Tracer wires are to be turned up at each end. The wires are to be encased in all duct banks and direct buried conduit. Tracer wire is to be #10 *copper*, white stranded, continuous, no underground connections permitted.

3.02 MANHOLES

- .1 All manholes to be provided by the Electrical Contractor as noted.

3.03 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.
- .8 Provide pulling eyes in main Electrical Rooms as required to ease the cable installation and protect the cables. Coordinate the pulling eye installation with Structural Consultant, rebar installation and concrete pour schedule.

3.04 MARKERS

- .1 Mark cable every 50 m along duct runs and changes in direction.
- .2 Where markers are removed to permit installation of additional cables, reinstall the markers.
- .3 Lay concrete markers flat and centered over cable.
- .4 Mark location of duct runs under hard surfaced areas not terminating in manhole with railway spike driven flush in edge of pavement, directly over run. Provide a marker system for finished floor areas. Place concrete duct marker at ends of such duct runs. Construct markers and install flush with grade. Coordinate marker locations with Prime Consultant and DEPARTMENTAL REPRESENTATIVE. Ensure finished floors are not damaged.

3.05 TESTING

- .1 Perform tests in accordance with Electrical Specifications and Commissioning section.
- .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests.

-
- .1 After installing cable(s) but before splicing and terminating, the Contractor shall perform insulation resistance test with 1000V megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
 - .3 Replace all damaged cables.
 - .6 Acceptance Tests
 - .1 Ensure that terminations and accessory equipment is disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .7 Conduct hipot testing in accordance with IPCEA recommendations.
 - .8 Provide the Consultant and DEPARTMENTAL REPRESENTATIVE's Project Administration the test results showing the location at which each test was made, circuit tested and result of each test.
 - .9 Remove and replace entire length of cable if the cable fails to meet any of the test criteria.

3.06 INSPECTIONS

- .1 Advise the Consultant and Departmental Representative Project Administration Team a minimum of one (1) week prior so that they may inspect ducts prior to the placement of concrete and be present during clean-out process.
- .2 Notify Departmental Representative Project Administration Team and arrange an inspection prior to placement of concrete.
- .3 Contractor shall provide digital photographs for record and the location of where the digital photographs were taken shall be cross-referenced on the record drawings fully dimensional.
- .4 Digital photographs shall be included in manuals or incorporated within the Electronic Record Drawing Files.

END OF SECTION

1 GENERAL

NIL

2 PRODUCTS

2.01 MATERIALS

- .1 Provide pressure type wire connectors with current carrying parts of copper sized to fit copper conductors as required.
- .2 Provide fixture type splicing connectors with current carrying parts of copper sized to fit copper conductors No. 10 AWG or less.
- .3 Provide bushing stud connectors in accordance with EEMAC 1Y-2-1961 to consist of:
 - .1 A connector body and a stud clamp for stranded copper conductors.
 - .2 A clamp for stranded copper conductors
 - .3 Stud clamp bolts as required.
 - .4 Bolts for the copper conductors.
 - .5 Sized for the conductors as indicated.
- .4 Provide clamps or connectors for the armoured cable, flexible conduit, as required.

3 EXECUTION

3.01 INSTALLATION

- .1 Remove the insulation carefully from the ends of the conductors and:
 - .1 Apply a coat of zinc joint compound on the aluminum conductors prior to the installation of the connectors;
 - .2 Install the mechanical pressure type connectors and tighten the screws with an appropriate compression tool recommended by the manufacturer. The installation must meet the secureness tests in accordance with CSA C22.2 No. 65-13;
 - .3 Install the bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

1 GENERAL

1.01 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Electrical General Provisions.
- .2 Shall include schematics, wiring, and interconnection diagrams.

2 PRODUCTS

2.01 STANDARDS

- .1 Provide control relays designed, manufactured and tested in accordance with CSA Standard C22.2 No. 14:-13 Industrial Control Equipment

2.02 MANUFACTURERS

- .1 Provide control devices of one (1) manufacturer (except thermostats).
- .2 AC Control Relays
- .3 Electrically held with field convertible contact cartridges and the following characteristics:
 - .1 Coil rating: 120 V;
 - .2 Contact rating: EEMAC A600 & P300;
 - .3 4-contacts;
- .4 Double voltage, electrically held with a sliding barrier to permit access to the only the contact compartment or the coil compartment at any one (1) time, field convertible contact cartridges and the following characteristics:
 - .1 Coil rating: 120 V;
 - .2 Contact rating: EEMAC A600 & P300;
 - .3 4-contacts in the contact compartment and 2 contacts in the coil compartment;
- .5 DC Control Relays
- .6 Electronically held with field convertible contact cartridges, economizing coil and the following characteristics:
 - .1 Coil Rating: 24 V DC;
 - .2 Contact Rating: EEMAC A300 & P300;
 - .3 4-Contacts;
- .7 Selector switches:
 - .1 Type A:
 - .1 Duty: Standard;
 - .2 Operator type: Standard;
 - .3 Operator colour: black as indicated;
 - .4 Nameplate type: metal, engraved with contrasting letters as indicated;
 - .5 2-position, maintained;
 - .6 3-position, maintained;
 - .7 One (1) normally open and one (1) normally closed contact
 - .8 Contact rating: EEMAC A600
 - .9 Enclosure: CSA enclosure 1

- .8 Pilot Lights:
 - .1 Type A:
 - .1 Heavy duty
 - .2 Push to test full voltage type for operation in a 120 V circuit.
 - .3 Lens colours: Red, green, amber, as indicated.
 - .4 Nameplate: Metal, engraved with contrasting letters, as indicated.
 - .5 Enclosure: CSA enclosure.
- .9 Relay Accessories
- .10 Standard contact cartridges field convertible between normally-open and normally-closed.
- .11 Sealed contact cartridges, normally open and normally closed as indicated.
- .12 Overlap contact cartridges supplied in pairs having a normally open contact that closes before the normally closed contact opens and vice versa.
- .13 Indexed mounting strips easily cut to the required length and bolted or rivetted in place. The relays are installed in rows on the strips with captive mounting screws.
- .14 Adder contact decks to add contacts in multiples of 4 contacts to the maximum of 12 contacts.
- .15 Mechanical latch attachment to convert an electrically held relay to a mechanically held relay.
- .16 Control And Relay Panels
- .17 Sheet steel CSA sprinkler-proof enclosure with hinged padlockable access door to accommodate all relays timers, terminals labels, wiring and all other components as indicated to the factory installed and wired to identified terminals
- .18 Solid State Timing Relays
- .19 Construction: AC operated electronic timing relay with a solid-state timing circuit to operate output contact. The timing circuit and output contact to be completely encapsulated for protection against vibration, humidity and atmospheric contaminants.
- .20 Operation: On-delay or off-delay.
- .21 Potentiometer: Self contained to provide time interval adjustment.
- .22 Supply Voltage: 120 V, 60 Hz.
- .23 Operating temperature range: -20°C to 60°C.
- .24 Contact rating: EEMAC B300 and P300.
- .25 Timing ranges: Continuously adjustable over the range 0.1 s. to 30 s. or as required.
- .26 Control Circuit Transformers
- .27 Single-phase, dry type.
- .28 Primary voltage: to match the equipment line voltage.
- .29 Secondary voltage: 120 V unless otherwise indicated.
- .30 Rating: 50 VA or the actual load plus 20%, whichever is the greater unless otherwise indicated.
- .31 Secondary fuse: size for the actual load x 2.5 or the next largest standard size unless otherwise indicated. Provide an integrally mounted fuse holder.
- .32 Close voltage regulations as required by magnet coils and solenoid valves.

- .33 Operator Control Stations
- .34 Pushbuttons:
 - .1 Type A:
 - .1 Duty: Standard;
 - .2 Operator type: recessed;
 - .3 Operator colour: red and green as indicated;
 - .4 Nameplate type: metal, engraved with contrasting letters as indicated;
 - .5 Provision for padlocking in the depressed position;
 - .6 1 normally open and 1 normally closed contacts;
 - .7 Contact rating: EEMAC A600;
 - .8 Enclosure: CSA sprinkler-proof enclosure;

3 EXECUTION

3.01 INSTALLATION

- .1 Install the pushbutton stations and control devices as indicated or required and interconnect them as indicated.

3.02 TESTS

- .1 Perform tests to ensure a complete operational system.
- .2 Depending upon the magnitude and complexity, divide the control system into convenient sections, energize one (1) section at a time and check out the operation of the section.
- .3 Undertake the group testing upon completion of the sectional tests.
- .4 Check out the complete system for operational sequencing.
- .5 Submit one (1) copy each of the test results to:
 - .1 General Contractor;
 - .2 Prime Consultant;
 - .3 Electrical Consultant;
 - .4 Commissioning Agent.

END OF SECTION

1 GENERAL

1.01 RELATED WORK

- .1 Section 26 05 53: Identification for Electrical Systems.
- .2 Section 26 05 15: Backboards.
- .3 Section 26 29 01: Contactors.
- .4 Commissioning Section.

1.02 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 26 05 01.
- .2 Drawings must include:
 - .1 electrical details of the panelboards;
 - .2 branch breaker type and interrupting capacity;
 - .3 branch breaker quantity;
 - .4 mains ampacity, voltage and number of poles and wires;
 - .5 surface or recessed mounting;
 - .6 main breaker or lugs description;
 - .7 enclosure dimensions;
 - .8 nameplate description and lettering.

1.03 PLANT ASSEMBLY

- .1 Install the circuit breakers in the panelboards before shipment.
- .2 In addition to CSA requirements, the manufacturer's nameplate must show the fault current that the panelboard including the breakers, has been built to withstand.
- .3 If additional breakers are added during construction, the Consultant reserves the right to have the manufacturer review the installation.
- .4 All panelboards shall have nameplates with ratings.

1.04 STANDARDS

- .1 Design, manufacture and test the panelboards in accordance with good industry practice and the following Standards and Codes:
 - .1 CSA Standard C22.1-Canadian Electrical Code, Part 1;
 - .2 CSA Standard C22.2 No. 29-15 Panelboards and Enclosed Panelboards

2 PRODUCTS

2.01 PANELBOARDS

- .1 All the panelboards must be the product of one (1) manufacturer.
- .2 For 250 V panelboards, the bus, the main breaker and the branch breakers must be rated for a minimum of 10000 A (symmetrical) interrupting capacity except as otherwise indicated.
- .3 For 600 V panelboards, the bus, the main breaker and the branch breakers must be rated for a minimum of 24000 A (symmetrical) interrupting capacity except as otherwise indicated.

- .4 Sequence the phase bussing with the odd numbered breakers on the left and the even numbered breakers on the right.
- .5 Provide the panelboards with the mains ratings, the number of circuits, and the number and size of the branch circuit breakers as indicated.
- .6 Provide two (2) keys for each panelboard provided with a door and key all panelboards alike.
- .7 Provide a copper main bus of the voltage and ampere ratings as indicated.
- .8 Bus for 120/208V panels shall be 200% rated, where noted.
- .9 Provide a copper 200% rated neutral bus of the same ampere rating as the mains for all 250V boards, where noted.
- .10 Provide copper ground bus.
- .11 Provide bolt-on breakers. Plug in breakers are not acceptable.
- .12 Hot dip galvanize the panelboard tubs after fabrication or acid etch, prime and apply two (2) finish coats of air dried ASA 61 grey enamel to the panelboard tubs.
- .13 Acid etch, prime and apply two (2) finish coats of air dried ASA 61 grey enamel to the panelboard trims and doors except as otherwise indicated.
- .14 Provide doors with concealed hinges, locks and hardware for all panelboards including main breakers distribution panelboards and power panels unless otherwise indicated. For recessed panelboards, provide chrome plated hardware where exposed.
- .15 Typed directories mounted on a metal frame with clear plastic cover identifying each branch circuit.

2.02 SPECIAL FEATURES

- .1 Provide double section panelboards as indicated or as required. Wall depth dimension shall be submitted and coordinated with Consultant.
- .2 Provide a Class A, Group 1, GFCI, 5 mA ground fault protection on those branch breakers as indicated.
- .3 Provide a 0.24" (6 mm) thick, laminated phenolic, cable entrance plate as indicated.
- .4 Provide sprinklerproof shields on all surface mounted panelboards.
- .5 Panelboards on UPS power shall be finished with Gold Tri-star No. 410 (navy blue).
- .6 Provide a contactor on the panel mains as indicated.
- .7 Provide double lugs neutral for all panels and where double neutral feeders are shown.
- .8 Provide maximum height (92") for all distribution type panelboards unless otherwise noted.
- .9 Provide power on pilot light indicator (green) and emergency shut-off push button and re-set key switch as indicated. Provide parallel remote push button where indicated.
- .10 Provide isolated and technical grounds bus for all audio/visual panel identified as "AV" or noted on circuiting drawings.

2.03 BREAKERS

- .1 Provide bolt-on moulded case circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40o ambient as indicated.
- .2 Provide multi-pole breakers with a common-trip device and a single handle.

- .3 Provide a separately mounted main breaker, where indicated, at the top or the bottom of the panelboard to suit the cable entry. When mounted vertically, the handle "DOWN" position should be the "OPEN" position.
- .4 Provide padlocking devices where noted on circuit breakers to lock the handle of a breaker in the "ON" or "OFF" position with the trip units to remain free to function and protect the circuit from both overload and short circuit conditions.
- .5 Provide lock-on devices for branch breakers controlling fire alarm, clock outlet, emergency, door supervisory, intercom, stairway, exit, shunt trip and night light circuits and as indicated.
- .6 Provide moulded case circuit breakers to operate automatically by means of thermal and magnetic tripping devices to provide an inverse time vs current tripping characteristic.
- .7 Where a 15A or 20A circuit breaker at 347V and less is used as the only switching device for luminaires, the circuit breaker shall be suitable for switching duty and shall be marked "SWD".
- .8 With thermal and adjustable magnetic trip mechanisms on all ratings 125 amperes and larger.

2.04 EQUIPMENT IDENTIFICATION

- .1 Provide a Size 3 nameplate for each panelboard engraved as per Electrical Specifications.
- .2 Provide a Size 2 nameplate for each circuit in distribution panelboards engraved as per Electrical Specifications. Provide a complete typewritten circuit directory with a clear plastic cover showing the location and load of each circuit for all other panelboards.

2.05 SPARE BREAKERS

- .1 Provide five (5) spare breakers for each size of breaker.
- .2 Provide steel cabinet with hinged lockable door and metal shelves to house all breakers and locate in Main Electrical Room.

EXECUTION

2.06 INSTALLATION

- .1 Locate the panelboards as indicated and mount them securely, plumb, true and square, to the adjoining surfaces.
- .2 Install the surface mounted panelboards on fire rated plywood backboards. Where practical, group panelboards, and other electrical equipment if present, on common backboard.
- .3 Mount the panelboards 60" (1500 mm) above the finished floor level to the panelboard centreline unless otherwise indicated. Where two (2) or more different size panelboards are installed adjacent to each other, align the tops of the panelboards to suit the tallest panelboard.
- .4 Connect the loads to the branch breakers as indicated.
- .5 Connect the neutral conductors to the common neutral bus.
- .6 Connect the isolated ground conductors to the isolated ground bus if provided.
- .7 Connect the main feeder to the main lugs or to the main breaker and to the neutral bus and the isolated ground bus if provided.
- .8 Padlocking devices shall be factory installed on all circuit breakers.
- .9 Provide two (2) spare 2" empty conduits for recessed panels for future use.
- .10 Contractor shall terminate one (1) 2" empty conduit in an accessible ceiling space location on that floor and provide one (1) 2" empty conduit terminated in an accessible ceiling to the ceiling below the floor (ceiling space) and label conduits. Refer to Section 26 05 34.

2.07 COMMISSIONING

- .1 Provide commissioning as per Electrical Specifications.

END OF SECTION

1 GENERAL

1.01 RELATED WORK

- .1 Wiring and Cables up to 1000 V.
- .2 Outlet Boxes, Conduit Boxes and Fittings.
- .3 General Provisions.

1.02 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Electrical Specifications.

1.03 WIRING DEVICE COLOURS AND STYLES

- .1 The Electrical Contractor shall submit a sample board of all combinations noted below for review by the Architect and Owner prior to shop drawing submission.
- .2 Provide wiring devices and coverplates colour combinations for this project as follows:
 - .1 All receptacles mounted in white painted type walls only to be white rectangular face type and white rectangular rocker type switches complete with white coverplate.
 - .2 All receptacles mounted in other painted walls to be grey rectangular face type receptacles and grey rectangular rocker type switches complete stainless steel coverplate.
 - .3 Standard white face receptacles and white toggle switches complete stainless steel coverplate for service rooms, Electrical, Mechanical Rooms, Janitor Closets.
 - .4 Outdoor Areas: Standard grey face receptacles complete with gasketted hinged weatherproof coverplate.

2 PRODUCTS

2.01 SWITCHES

- .1 Provide specification grade, line voltage light switches of the toggle type with the yoke insulated from the silent operating mechanism. Provide large and well recessed binding screws, suitable for No. 10 AWG wire, for easy wiring and with the operating mechanism totally enclosed in a strong phenolic colour coded (with respect to current rating) housing. Provide silver alloy contacts and use urea or melamine for those housing parts subject to carbon tracking.
- .2 Provide rectangular face type 20A, 120V switches as indicated below:
 - .1 Single pole: Pass & Seymour Series # 2621;
 - .2 3-way: Pass & Seymour Series # 2623;
 - .3 4-ways: Pass & Seymour Series # 2624.

2.02 RECEPTACLES

- .1 Provide standard face specification grade duplex receptacles, CSA configuration 5-15R, 125V, 15A, U ground, with the following features:
 - .1 Nylon insulated housing; colour as noted;
 - .2 Suitable for No. 10 AWG wire for back or side wiring;
 - .3 Break-off links for use as split receptacles;

- .4 Pass & Seymour Series No. 26252.
- .2 Provide rectangular face specification grade duplex receptacles, CSA configuration 5-15R, 125V, 15A, U ground with the following features.
 - .1 Nylon moulded housing; colour as noted;
 - .2 Suitable for No. 10 AWG wire for back or side wiring;
 - .3 Break-off links for use as split receptacles;
 - .4 Pass & Seymour Series No. 26252.
- .3 Provide ground fault circuit interrupting duplex receptacles, CSA configuration 5-15R, 125 V, 15 A, U ground with the following features:
 - .1 White nylon moulded housing;
 - .2 Pass & Seymour Series No. 1595.
- .4 Provide other outlets shown on drawings as required.
- .5 Installation Provide cover plates for all wiring devices.
- .6 Provide galvanized sheet steel utility box covers for wiring devices installed in surface-mounted utility boxes.
- .7 Provide vertically brushed stainless steel, cover plates 0.04" (1 mm) thick for wiring devices mounted in flush-mounted outlet boxes.
- .8 Provide sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .9 Provide weatherproof, double lift, spring-loaded, cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.
- .10 Provide vertically brushed stainless steel coverplate (blank) for future outlet. Provide accessories to adapt to this requirement.

2.03 IDENTIFICATION

- .1 Provide Nameplates Indicate Panel, Circuit Number, Functions, Etc. For Each Outlets and Switches as noted in Electrical Specification.
- .2 Automatic spring retraction and ratchet lock.
- .3 Cord guides with 4 rollers.
- .4 Pivot Base Mounting.
- .5 Acceptable Manufacturers:
 - .1 Woodhead 997 Series;
 - .2 Hubbell HBL 45 Series;
 - .3 Gleason GCA Series.

3 EXECUTION

3.01 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with the handle in the "UP" position when the switch is closed.
 - .2 Install switches in ganged outlet boxes when more than one (1) switch is required in one (1) location with the exception of dimmers.
- .2 Receptacles:

- .1 Install receptacles in ganged outlet boxes when more than one (1) receptacle is required in one (1) location.
- .2 Mount receptacles with the long dimension vertically at the height specified unless otherwise indicated.
- .3 Coverplates:
 - .1 Protect the stainless steel coverplate finish with paper or plastic film until the painting and other work is finished.
 - .2 Install suitable common coverplates where wiring devices are grouped.
 - .3 Refer to specifications for identification requirements.

3.02 COMMISSIONING

- .1 Provide commissioning as per Electrical Specifications.

3.03 MANUFACTURERS

- .1 Provide wiring devices and coverplates of one (1) manufacturer.
- .2 Pass & Seymour Catalogue numbers are shown and indicate the quality of the wiring devices and cover plates required. Equivalent wiring devices and cover plates of the manufacturers listed below may be use. Acceptable manufacturers are:
 - .1 Pass and Seymour;
 - .2 Hubbell Canada Inc.

END OF SECTION

1 GENERAL

1.01 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit the characteristics for each fuse type and size including the average melting time versus current curve, (i²t) (for fuse coordination), and peak let-through current.

1.02 DELIVERY AND STORAGE

- .1 Ship the fuses in their original containers.
- .2 Do not ship any fuses installed in equipment.

1.03 STANDARDS

- .1 Design, manufacture and test all fuses in accordance with good industry practice and in accordance with the following Standard:
 - .1 CSA Standard C22.2 No. 106-05 (R2014) – HRC – Miscellaneous Fuses

2 PRODUCTS

2.01 FUSES GENERAL

- .1 Provide only HRC fuses having an interrupting rating of 200,000. A symmetrical and a voltage rating of 600 V, unless otherwise indicated.
- .2 Special equipments such as VFD(variable frequency drive) requires protection as per manufacturer recommendations. This should be followed based on formal documents from manufacturer.
- .3 Time delay fuses must carry 500% of their rated current for a minimum of 10 s and be marked "Time Delay".

2.02 FUSE TYPES

- .1 Provide CSA designation HRCI-J fuses for lighting and general loads without inrush, 600 A and lower.
- .2 Provide CSA designation HRCI-J Time Delay fuses for motors, transformers and other loads with an inrush, 600 A and lower.
- .3 Provide CSA designation HRC-L fuses for lighting and general loads without an inrush above 600 A.
- .4 Provide CSA designation HRC-L Time Delay fuses for motors, transformers and other loads above 600 A with an inrush.
- .5 CSA designation HRCI-JY fuses are not permitted.

2.03 MANUFACTURERS

- .1 Provide fuses of one (1) manufacturer. Acceptable manufacturers are:
 - .1 Ferraz Shawmut;
 - .2 Bussmann

3 EXECUTION

3.01 INSTALLATION

- .1 Install the fuses in the fuse clips immediately before energizing the circuit.
- .2 Ensure that the fuse clips are physically matched to the fuse type and size.
- .3 Ensure that the correct fuses are fitted to the assigned electrical circuits.

END OF SECTION

1 GENERAL

1.01 STANDARDS

- .1 CAN/CSA-C22.2 No. 144-M91 (R2015): Ground Fault Circuit Interrupters
- .2 CSA C22.2 No. 5-13 Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit Breaker Enclosures
- .3 Ontario Electrical Safety Code
- .4 UL 489- Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
- .5 IEEE C37.17 American National Standard for trip devices for AC and general purpose DC low voltage power circuit breakers
- .6 NEMA-AB1 2002 Molded Case Circuit Breakers and Moulded Case Switches
- .7 ANSI C37.50 - 2012 American National Standard for Switchgear – test procedures for low voltage AC power circuit breakers used in enclosures
- .8 IEEE Standard 1015-2006 Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
- .9 ANSI/NETA–ATS 2013 Acceptance Testing Specifications for Electrical Power Equipment and Systems.
- .10 Short Circuit, System Coordination and Arc Flash Hazard.
- .11 Commissioning section.

1.02 PRODUCT DOCUMENTATION

- .1 Submit and prepare shop drawings in accordance with the Electrical Specifications. They shall include details such as dimensions, clearances required, cable entries, tabulation of all devices including tags, wiring diagrams (power, signals, control wiring). The notes will identify field wiring and factory installed wiring)
- .2 Include time-current characteristic curves for breakers with ampacity of 150A and over. In some cases due to critical nature of the equipment smaller size breaker may have to be verified for Time Current Coordination as well.
- .3 Fabrication must suit coordination study.

2 PRODUCTS

2.01 BREAKERS GENERAL

- .1 Provide molded case circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient as indicated.
- .2 The purpose of selecting right type of circuit breaker is to comply with System Coordination. It is the responsibility of the supplier to ensure that a necessary study is carried out or professional judgment is sought before offering the breakers. This includes inrush from number of transformers that can be energized by single breaker.
- .3 Provide multi-pole breakers with a common-trip device and a single handle.

- .4 Provide magnetic instantaneous trip elements in circuit breakers, to operate only when the value of the current reaches the setting, as indicated. For breakers with adjustable trips, provide a trip range of 3 to 10 times the rated current or as indicated.
- .5 Provide circuit breakers with interchangeable trips as indicated.
- .6 Provide pad locking devices on all breakers to lock the handle of a breaker in the "on" or "off" position with the trip units to remain free to function and protect the circuit from both overload and short circuit conditions.
- .7 With thermal and adjustable magnetic trip mechanisms on all ratings 125 amperes and larger.

2.02 THERMAL MAGNETIC BREAKERS (TMB) (A)

- .1 Provide molded case circuit breakers to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping characteristic.

2.03 SOLID STATE TRIP BREAKERS DESIGN (LSI, LSIG AS INDICATED) (D)

- .1 Provide molded case circuit breakers to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip devices to provide an inverse time vs current trip characteristic under overload conditions, and long time short time instantaneous tripping for phase ground fault short circuit protection. The trip unit shall be fully adjustable current and time characteristics. All breakers 400 A above shall be solid state type (LSIG).

2.04 OPTIONAL FEATURES

- .1 Provide shunt trip devices, with 120 V AC coils as indicated, to provide remote tripping on breakers 600A and up.
- .2 Provide closing coils, with 120 V AC coils as indicated, to provide remote/automatic closing where indicated.
- .3 Provide auxiliary switches, rated at 5 A and 120 V as indicated, to operate remote devices where indicated. Circuit breakers rated 800A or larger shall have contacts rated 10A at 240V.
- .4 Provide motor operated mechanisms, with 120 V motors as indicated, to provide remote operation where indicated. This will be provided with electrical closing mechanism.
- .5 Provide NEMA and UL rated enclosures for individual breakers as required.

3 EXECUTION

3.01 EXAMINATION

- .1 Examine the circuit breakers for compliance with installation tolerances and other conditions affecting performance. Proceed with installation only after satisfactory compliance.

3.02 INSTALLATION

- .1 Circuit breakers in panelboards shall be factory installed.
- .2 Install individual breakers where indicated

3.03 IDENTIFICATION

- .1 Identify all field installed conductors, wiring and components; provide warning signs as required by manufacturer and also the Ontario Electrical Safety Code

3.04 CONNECTION

- .1 Install grounding connections, power wiring and indication devices. Verify the torque recommended by manufacturer.

3.05 TESTS

- .1 Test for continuity of phase and ground connections and insulation resistance (Megger) for each phase to phase and phase to ground.
- .2 Verify all acceptance tests as per NETA test procedure.
- .3 Any malfunctioning of the units shall be corrected and retested to demonstrate compliance.

3.06 COMMISSIONING / SUBMITTALS

- .1 Field test reports: Include the test procedures and instruments used. Record test results for formal submission to Consultant and Departmental Representative for information.
- .2 Final maintenance manual shall include all the routine maintenance requirements and complete information about each circuit breaker settings.

END OF SECTION

1 GENERAL

1.01 PRODUCT DATA

- .1 Submit product data in accordance with Electrical General Provisions.

1.02 STANDARDS

- .1 Design, manufacture and test all disconnect switches in accordance with good industry practice and in accordance with the following Standards and Codes:
 - .1 CAN/CSA Standard C22.2 No. 4-04 (R2014) - Enclosed and Dead-Front Switches
 - .2 CSA Standard C22.2 No.39-13- Fuseholder assemblies.

2 PRODUCTS

2.01 DISCONNECT SWITCHES

- .1 Provide heavy duty type fusible and non-fusible disconnect switches in CSA Enclosure to suit the environment where the switch is located.
- .2 Provide the provision for padlocking the switch in the "ON" and "OFF" switch position by up to three (3) locks.
- .3 Mechanically interlock the door with a voidable interlock to prevent the door opening when the switch handle is in the "ON" position.
- .4 Provide fuses of the size as indicated in accordance with low voltage fuses section.
- .5 Provide fuseholders, suitable without adaptors, for the size of the fuses as indicated.
- .6 Provide a type A quick-make, quick-break switching action with arc chutes or arc snuffers.
- .7 Provide a vertically moving handle with an "ON-OFF" switch position indication on the switch enclosure cover with the "ON" position being the upper handle position.
- .8 Provide solderless neutral terminals where indicated.
- .9 Provide dust-proof for all welding equipment.
- .10 Provide unfused disconnect switches for motors where required by Code.

2.02 EQUIPMENT IDENTIFICATION

- .1 Provide an equipment identification nameplate in accordance with Section 26 05 53.

3 EXECUTION

3.01 INSTALLATION

- .1 Install the disconnect switches, complete with fuses, as indicated.

END OF SECTION

1 GENERAL

- .1 System Description: solar Photovoltaic system distributed on ground as follows:

PV SYSTEM	FIXED ARRAY SYSTEM
AC SIZE	1.0 KW
DC size	1.2KW
MODULE	300W ,TYPE TBD
NUMBER OF MODULE	4
RACKING	Fixed Array system
INVERTER	1.2 KW

- .2 The Issue for Tender drawings are the base design drawings. The solar PV contractor is free to suggest equipment suitable for this project, provided the design requirements of these specifications are met and CORA approves the proposed equipment.
- .3 Stantec is to revise the tender drawings for construction purposes based on the final equipment selected by the owner.
- .4 The solar PV contractor is to carry-out the procurement, installation, and commissioning of the solar PV system.
- .5 General Requirements: Conform with requirements of these Solar PV Specifications and the Solar PV General Electrical Notes on drawing.
- .6 Contractor shall obtain and maintain all permits and licenses required to perform and complete its work, unless otherwise indicated.

2 PERFORMANCE REQUIREMENTS

- .7 The solar PV system should be designed and built to support washroom facility.
- .8 The forecasted energy production is to be shown in PVSyst using as-built conditions and typical mean year meteorological data. The final energy production forecast is to use actual design parameters, calculated losses, and specifications of the installed equipment.

3 DESIGN REQUIREMENTS

- .9 The design must meet the Ontario Electrical Safety Code standards.
- .10 The design must meet the Ontario Building Code.

- .11 The solar PV system must have a nameplate capacity of 1.2kWac as per the FIT 5 contract application.
- .12 The solar module configuration and orientation should be optimized for energy production over the course of a full year.
- .13 The solar PV system should be designed for a minimum shade free window between 11am to 1pm on December 21st (worst case).
- .14 The solar modules must stay clear of skylights, drains, walkway pavers and other obstructions.
- .15 The fixed solar racks should have water channels underneath and not obstruct water drainage.
- .16 The inverters should be tamper proof and installed so they are out of reach of the public.
- .17 The solar PV system should include lightning arrestors as additional protection in the inverters.
- .18 Performance Monitoring: The solar PV system should include a performance monitoring system at the inverter level to allow the owner to remotely observe over the internet the system status and energy production recorded.
- .19 A maximum DC average voltage drop of 1%; inclusive of string PV source circuits and PV output circuits. DC Voltage Drop = Average PV Source Circuit Voltage Drop + Average PV Output Circuit Voltage Drop.
- .20 A maximum AC average voltage drop of 1%; inclusive of all AC cables. AC Voltage Drop = Average Inverter Cable Voltage Drop + Average Sub Panel Cable Voltage Drop + Average Transformer Cable Voltage Drop.

4 **EQUIPMENT REQUIREMENTS**

- .21 Solar Module: Minimum module power rating of 300W STC. CSA approved. Minimum 20-year performance warrant. Minimum 10-year materials and workmanship warranty.
- .22 Inverter: CSA approved. Minimum 98% CEC efficiency. Includes Arc Fault Circuit Interrupter. Anti-Islanding Protection. Tamper proof. Outdoor NEMA 4X rated. Minimum 10-year warranty.
- .23 Performance Monitoring: Performance monitoring system compatible with the inverters to remotely observe over the internet the system status and energy production recorded.
- .24 Fixed Racking: Rust proof. Wind tunnel tested. Minimum 10-year warranty. Allows water to flow underneath. Includes protective padding under the racking.
- .25 Combiner boxes, Disconnects, Junction Boxes and Sub-Pannels are all to be CSA approved.
- .26 Conductors: Conductors are to be sun resistant and not placed in continuous direct sunlight.
- .27 Connectors: CSA approved. Same type and brand name connectors should be used between the modules and conductors.

5 **EXAMINATION**

- .28 Examine areas and conditions, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

- .29 Examine area to verify actual locations of equipment, cable lengths and routing before equipment installation.
- .30 Proceed with installation only after unsatisfactory conditions have been corrected.

6 **INSTALLATION**

- .31 Install all equipment per manufacturers' manuals and instructions.
- .32 Install all solar panels and complete panel to panel interconnection in series using panel manufacturer approved connectors, providing jumper cables and connectors when required.
- .33 Place string cables behind the solar panels. Coil the excess cable. Secure the cable to the metal frame racking with heavy-duty sunlight resistant zip tie or approved clips at 80cm spacing.
- .34 All conductors should be mechanically protected, fastened, and routed professionally with cable management fasteners. Conductors should be kept clear of sharp edges.
- .35 Do not exceed the minimum bending radius of the cable.
- .36 Provide weather resistant labeling for all string wiring, at both ends, installed between the array and the harness, UV resistant if exposed to the sun.
- .37 Install Conduit runs with supports for cable as needed.
- .38 Cable trays, combiner boxes, inverters etc must not contribute to additional shading on the array.
- .39 Supply and install flashing over vertically mounted teck cable on exterior of building.
- .40 Do not use metal LB's. Provide goose neck bends where possible.
- .41 Bonding and grounding of inverter as per manufacturer requirements.
- .42 Install complete DC system grounding, including panels, racking systems, combiner boxes as per single line diagram, CSA requirements, local electrical code, and manufacturer specifications.
- .43 Install complete AC system grounding as per single line diagrams, CSA requirements, local electrical code, and manufacturer specifications.
- .44 Ensure the installation of fixed array racking system meets the structural drawing requirements as per manufacturer.
- .45 Provide weather resistant labeling and signage as per the construction drawings.
- .46 Connect and install specified Performance Monitoring System to data connection.
- .47 Secure covers to all enclosures.

7 **FIELD QUALITY CONTROL**

- .48 Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- .49 Perform tests and inspections with the assistance of a factory-authorized service representative.
- .50 Submit legible red-lines of construction drawings in PDF format upon completion of construction highlighting changes.

- .51 Solar PV equipment will be considered defective if it does not pass tests and inspections.
- .52 Prepare test and inspection reports.

8 STARTUP SERVICES

- .53 Engage a factory-authorized service representative to perform startup service.
- .54 Complete installation and startup checks per manufacturer's written instructions.
- .55 Submit drawings, equipment warranties and manuals in a binder to the owner.

END OF SECTION

1 General

1.01 RELATED SECTIONS

.1	Electrical General Provisions	Section 26 05 00
.2	Interior Lighting	Section 26 51 16
.3	Interior Drivers and Accessories	Section 26 51 19
.4	Exterior Lighting	Section 26 56 00
.5	Lighting Poles and Standards	Section 26 56 13

1.02 WORK INCLUDED

- .1 This section includes for supply and installation of luminaires, lamps, drivers, supports and accessories, and for supply of plaster frames, trim rings and backboxes for plaster or drywall ceilings or concrete

1.03 COORDINATION WITH OTHER SECTIONS

- .1 Confirm compatibility and interface of other materials with luminaire and ceiling system. Report discrepancies to the Owner and defer ordering until clarified.
- .2 Supply plaster frames, trim rings and backboxes to other trades as the work requires.
- .3 Coordinate with Mechanical Contractor to avoid conflicts between luminaires, supports, fillings and mechanical equipment.

1.04 APPROVAL OF ALTERNATIVES

- .1 See Section 26 05 01.

1.05 SUBMITTALS

- .1 Samples of luminaires noted are required for approval prior to final production.
- .2 Construction and performance of luminaires, subject to approval of the Owner.
- .3 Provide, if requested by the Owner, complete photometric data and heat dissipation reports from independent testing laboratory.
- .4 Shop drawings for all luminaires showing all pertinent physical characteristics.

1.06 LUMINAIRE DESIGNATION

- .1 Interior:
- .2 Exterior:

1.07 RECESSED LUMINAIRES

- .1 Install recessed luminaires to permit removal from below, to gain access to outlet or prewired luminaire box. Connect recessed luminaires to boxes with flexible conduit and approved luminaire wire.
- .2 Supply recessed luminaire complete with trim type required for ceiling system installed. Before ordering, confirm ceiling construction details and architectural finish for each area.

1.08 SAMPLE LUMINAIRES

- .1 Submit for approval of Owner one of each luminaire type if requested before manufacturing commences. If directed by Owner, set up luminaire to show coordination with ceiling, mechanical diffuser assemblies, and other equipment. Luminaire, if approved, will be retained as a control standard. Luminaires not approved to be resubmitted.

1.01 1.09 ENERGY STAR AND/OR DLC CERTIFICATE.

- .1 Luminaires shall be CSA, cUL certified and shall be Energy Star and/or DLC certified.
- .2 All led luminaires shall conform with IESNA LM-79, IESNA LM-80 & LM-21, colour consistency 3-step macadam ellipse x binning (min).
- .3 Alternate luminaires shall have the same lighting characteristics, wattage, efficacy and efficiency with same lumen output or improved conditions.
- .4 Dimensions and colour finishing shall be approved by the Architects.

END OF SECTION

1 GENERAL

1.01 RELATED SECTIONS

- | | | |
|----|----------------------------------|------------------|
| .1 | Electrical General Provisions | Section 26 05 01 |
| .2 | Interior Drivers and Accessories | Section 26 51 19 |

2 PRODUCTS

2.01 STANDARD LINEAR LUMINAIRES

- .1 Luminaires: housing constructed of 20 gauge steel, prime coated and finished in high reflectance baked white enamel, two coats minimum on exposed and reflective surfaces, giving minimum reflectance of 85%. Housing to be 20 gauge steel post painted in powder enamel finish with minimum reflectance of 88%. No black markings to be visible from floor nor through refractor of all fluorescent luminaires.
- .2 Reflective steel plates to be constructed of 22 gauge metal. Hinged frames with approved catches to be removable for cleaning without the use of tools.
- .3 Provide gasketing, stops and barriers to form light traps to prevent light leaks.
- .4 Design luminaire for adequate dissipation of driver and lamp heat and provide, if requested, test reports from independent laboratory.
- .5 Construct rigid and well aligned luminaire, using formed or ribbed type plates, endplates, reinforcing channels, as required.
- .6 Diffusers: 100 per cent pure virgin acrylic, 0.125 inch thick minimum.
- .7 Surface or suspended luminaires shall have no exposed unused knockouts on side, faceplates or endplates.
- .8 All luminaire chassis to be rigid assembly using positive fastening devices such as spot welds or screws. Luminaires fastened by metal crimps or folds will not be accepted.

3 Execution

3.01 SUPPORTS – STANDARD LUMINAIRES

- .1 Refer to Section 26 05 29.
- .2 Support standard luminaires directly from building structure by rod hangers and inserts, on metal angle headers supported from framing structure of ceiling suspension system.
- .3 Provide plaster frames or plaster trim as required and turn same over to the ceiling section for installation.
- .4 Support luminaires larger than 610 mm in width by four hangers per luminaire minimum independent of ceiling structure or tee bars.
- .5 For recessed luminaires mounted in suspended ceiling with exposed tee bar grid system, support from the ceiling tee bar grid structure provided the ceiling tee bar grid structure is designed to carry the weight of the luminaires. Co-ordinate with the division supplying and installing the ceiling grid and submit a written confirmation to the requirements of the Inspection Authority. Otherwise, support luminaires as described above.

3.02 LUMINAIRES

- .1 Align luminaires and clean diffusers prior to final acceptance.

3.03 LUMINAIRE SCHEDULE

- .1 Provide all luminaires in accordance with the luminaire schedule shown on drawing.

END OF SECTION

1 GENERAL

1.01 RELATED SECTIONS

Electrical General Provisions	Section 26 05 01
Interior Lighting	Section 26 51 16
Exterior Lighting	Section 26 56 00

1.02 SUMMARY

- .1 This section describes the type of drivers to be used in conjunction with the luminaires to be provided for the project.

1.03 REFERENCE STANDARDS

- .1 Drivers are to meet the current ANSI and FCC standards.
- .2 All luminaires shall meet the electro magnetic compatibility requirements of the IEC 61000 suite of standards.

1.01 SHOP DRAWINGS

- .1 Provide shop drawings for drivers. Shop drawings to identify which luminaire types the ballast is to be supplied in. Shop drawings are to be supplied along with the corresponding luminaire submittal.

2 Products

- .1 All DALI controlled lighting shall have drivers compliant with IEC 62386 – Digital addressable lighting interface (DALI).
- .2 All drivers shall have a Mean Time Before Failure (MTBF) of 50,000 hours or greater.
- .3 All drivers shall be fully compatible with the lighting control system installed and light source.

3 Execution

3.01 INSTALLATION

- .1 Provide drivers of compatible design to lamps specified and luminaire circuit voltage.
- .2 Integral drivers to be used with luminaires unless otherwise indicated on the drawings. Remote drivers identified on the drawings are to be contained within a CSA approved NEMA rated enclosure.
- .3 All luminaires to be “burned-in” at full illumination for a minimum continuous period of 100 hours at initial start-up prior to being dimmed, switched, or de-energized.

END OF SECTION

1 GENERAL

1.01 GENERAL

- .1 This section of the specification shall be read in conjunction with and be governed by the requirements of Electrical Specification.

1.02 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Electrical Specifications.
- .2 Data shall indicate system components, mounting method, source of power and special attachments.

1.03 WARRANTY

- .1 Refer to Electrical Specifications regarding requirements.

2 PRODUCTS

2.01 EQUIPMENT

- .1 Supply voltage: as noted in plans.
- .2 Output voltage: 12 V DC.
- .3 Operating time: 60 min. Provide units of a capacity to operate loads detailed on drawings. Plus spare capacity of 25%.
- .4 Battery: sealed, ten (10) year life, maintenance free.
- .5 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected and modular constructed.
- .6 Solid state transfer.
- .7 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .8 Signal lights: solid state, life expectancy 100,000 h minimum, for 'AC Power ON' and 'High Charge'.
- .9 Battery units shall be complete with unit mounted or remote 12W MR 16 LED units, Model MQM1/MQM2 Series. Identified on Luminaire Schedule and plans.
- .10 Luminaire remote heads: White. To be confirmed by architect.
- .11 Cabinet: suitable for direct or shelf mounting to wall and complete with knockouts for conduit.

- .12 Auxiliary equipment:
 - .1 Ammeter
 - .2 Voltmeter
 - .3 Lamp disconnect switch
 - .4 Test switch
 - .5 Time delay relay
 - .6 Battery disconnect device
 - .7 AC input and DC output terminal blocks inside cabinet.
 - .8 Bracket
 - .9 Cord and twist lock plug for AC connection. Refer to plans for voltage.
 - .10 RFI suppressors.
 - .11 Provide automatic self-diagnostic circuiting.

3 EXECUTION

3.01 INSTALLATION

- .1 Install unit equipment for emergency lighting in accordance with CSA C22.2-141 10 (R2015) Emergency Lighting Equipment and the Ontario Electrical Safety Code, 25th Edition.
- .2 Install unit equipment and remote mounted fixtures as indicated.
- .3 Coil and wrap excess cordset neatly.
- .4 Direct heads as indicated on site by the Consultant and/or authority having jurisdiction.
- .5 Conductors to remote lamps shall be sized for a maximum voltage drop of 5% of the rated unit output voltage, measured at the lamp terminals. Conductors shall be in conduit.

END OF SECTION

1 General

1.01 RELATED SECTIONS

- | | | |
|----|-------------------------------|------------------|
| .1 | Electrical General Provisions | Section 26 05 00 |
| .2 | Interior Lighting | Section 26 51 16 |

2 Products

2.01 LUMINAIRES

- .1 Provide luminaires complete with gaskets forming weatherproof assembly where exposed to weather.
- .2 Luminaire finishes to be satin aluminium, non corrosive types.
- .3 LED drivers shall operate trouble free under all exterior environments.

2.02 CONDUIT

- .1 Rigid threaded galvanized steel with watertight connectors and accessories where installed exposed to atmosphere and for a minimum distance of 1000 mm from concrete bases. All flexible connections to be made with Sealtite flexible conduit.

3 Execution

3.01 INSTALLATION

- .1 Steel conduit to be painted onsite to match structural components on which it is mounted.
- .2 Conductors to be RW90 X-link For underground installation use RWU90.
- .3 Install green insulated grounding conductor in all conduit runs associated with post type luminaires.
- .4 Seal all conduit runs at building panels, pullboxes, etc.
- .5 Luminaire Schedule
- .6 Refer to Drawings.

END OF SECTION

Approved: 2006-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 01 90.33 – Tree and shrub Preservation

1.2 MEASUREMENT PROCEDURES

- .1 Measure following items in hectares within limits as indicated:
 - .1 Clearing.
 - .2 Grubbing.
 - .3 Close cut clearing.
 - .4 Underbrush clearing.
- .2 Measure clearing isolated trees and grubbing isolated tree stumps as number of isolated trees cleared and number of isolated stumps grubbed.
- .3 Fixed price payments will be made for:
 - .1 Clearing.
 - .2 Close cut clearing.
 - .3 Clearing isolated trees.
 - .4 Grubbing.

1.3 REFERENCES

- .1 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.4 DEFINITIONS

- .1 Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
- .2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps, and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.
- .3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
- .4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.
- .5 Grubbing consists of excavation and disposal of stumps and roots to not less than specified depth below existing ground surface.

1.5 STORAGE AND PROTECTION

- .1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses and root systems of trees which are to remain.
 - .1 Repair damaged items to approval of Departmental Representative.
 - .2 Replace trees designated to remain, if damaged, as directed by Departmental Representative.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 MATERIALS

- .1 Soil Material for Fill:
 - .1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
 - .2 Remove and store soil material for reused.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PREPARATION

- .1 Inspect site and verify with Departmental Representative, items designated to remain.
- .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
 - .1 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
 - .2 When utility lines which are to be removed are encountered within area of operations, notify Departmental Representative in ample time to minimize interruption of service.
- .3 Notify utility authorities before starting clearing and grubbing.

- .4 Keep roads and walks free of dirt and debris.

3.3 APPLICATION

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

3.4 CLEARING

- .1 Clearing includes felling, trimming, cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, rubbish occurring within cleared areas.
- .2 Clear as indicated by Departmental Representative, cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.
- .3 Cut off branches overhanging area cleared as directed by Departmental Representative.
- .4 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.

3.5 CLOSE CUT CLEARING

- .1 Close cut clearing to within 100 mm of ground surface.
- .2 Cut off branches overhanging area cleared as directed by Departmental Representative.
- .3 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.

3.6 ISOLATED TREES

- .1 Cut off isolated trees as indicated by Departmental Representative at height of not more than 300 mm above ground surface.
- .2 Grub out isolated tree stumps.
- .3 Prune individual trees as indicated.
- .4 Trim trees designated to be left standing within cleared areas of dead branches 4 cm or more in diameter; and trim branches to heights as indicated.
- .5 Cut limbs and branches to be trimmed close to bole of tree or main branches.
- .6 Paint cuts more than 3 cm in diameter with approved tree wound paint.

3.7 UNDERBRUSH CLEARING

- .1 Clear underbrush from areas as indicated to within 50 mm of ground surface.

3.8 GRUBBING

- .1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200 mm below ground surface.

- .3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m³.
- .4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.9 REMOVAL AND DISPOSAL

- .1 Remove cleared and grubbed materials off site.
- .2 Remove diseased trees identified by Departmental Representative and dispose of this material to approval of Departmental Representative.

3.10 FINISHED SURFACE

- .1 Leave ground surface in condition suitable for stripping of topsoil to approval of Departmental Representative.

3.11 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, and equipment.

END OF SECTION

Approved: 2006-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 22 13 – Rough Grading

1.2 REFERENCES

- .1 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 STRIPPING OF TOPSOIL

- .1 Ensure that procedures are conducted in accordance with applicable Provincial requirements.
- .2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.
- .3 Handle topsoil only when it is dry and warm.
- .4 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation by alternative disposal.
- .5 Remove brush from targeted area by non-chemical means and dispose of through alternative disposal.
- .6 Strip topsoil to depths as indicated by Departmental Representative.
 - .1 Avoid mixing topsoil with subsoil.

- .7 Pile topsoil in berms in locations as directed by Departmental Representative.
 - .1 Stockpile height not to exceed 2.5 - 3 m.
- .8 Dispose of unused topsoil off-site.
- .9 Protect stockpiles from contamination and compaction.
- .10 Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.

3.3 PREPARATION OF GRADE

- .1 Verify that grades are correct and notify Departmental Representative. If discrepancies occur, do not begin work until instructed by Departmental Representative.
 - .1 Grade area only when soil is dry to lessen soil compaction.
 - .2 Grade soil establishing natural contours and eliminating uneven areas and low spots, ensuring positive drainage.

3.4 PLACING OF TOPSOIL

- .1 Place topsoil only after Departmental Representative has accepted subgrade.
- .2 Spread topsoil during dry conditions in uniform layers not exceeding 150 mm, over unfrozen subgrade free of standing water.
- .3 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.
- .4 Cultivate soil following spreading procedures.

3.5 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Approved: 2012-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 14 13 - Soil Stripping
 Section 32 91.13 - Topsoil Placement

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D698-07e1, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m³).
- .2 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations (including Addendum 2007).
 - .2 LEED Canada-NC-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.
 - .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Commercial Interiors.
 - .4 LEED Canada-EB: O M-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Existing Buildings: Operations and Maintenance 2009.
- .3 Underwriters' Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with [Section 01 35 21 - LEED Requirements].

1.4 EXISTING CONDITIONS

- .1 Examine subsurface investigation report which is bound into specifications.
- .2 Known underground and surface utility lines and buried objects are as indicated on site plan.

Part 2 Products

2.1 MATERIALS

- .1 Excavated or graded material existing on site suitable to use as fill for grading work if approved by Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for rough grading installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 STRIPPING OF TOPSOIL

- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Departmental Representative.
- .2 Commence topsoil stripping of areas as indicated by Departmental Representative after area has been cleared of brush, weeds, and grasses and removed from site.
- .3 Strip topsoil to depths as indicated by Departmental Representative. Rototill weeds and grasses and retain as topsoil on site. Avoid mixing topsoil with subsoil.
- .4 Stockpile in locations as indicated by Departmental Representative. Stockpile height not to exceed 2 m.
- .5 Dispose of unused topsoil off site.

3.3 GRADING

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.
- .2 Slope rough grade away from building 1:50 minimum.
- .3 Grade ditches to depth as indicated.
- .4 Prior to placing fill over existing ground, scarify surface to depth of 150 mm minimum before placing fill over existing ground. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .5 Compact filled and disturbed areas to corrected maximum dry density to ASTM D698, as follows:
 - .1 85% under landscaped areas.
 - .2 98% under paved and walk areas.

- .6 Do not disturb soil within branch spread of trees or shrubs to remain.

3.4 TESTING

- .1 Submit testing procedure, frequency of tests, testing laboratory as designated by ULC or certified testing personnel to Departmental Representative for review.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

- .1 Protect all structures, fencing, trees, landscaping, natural features, bench marks, buildings, pavement, and surface or underground utility lines which are to remain as directed by Departmental Representative. If damaged, restore to original or better condition unless directed otherwise.
- .2 Maintain access roads to prevent accumulation of construction related debris on roads.

END OF SECTION

Part 1 GENERAL REQUIREMENTS

1.1 RELATED REQUIREMENTS

- .1 311100 Clearing and Grubbing
- .2 311413 Soil Stripping and Stockpiling
- .3 320190-33 Tree and Shrub Preservation

1.2 MEASUREMENT PROCEDURES

- .1 Excavated materials will be measured in cubic metres in their original location.
 - .1 Excavation quantities measured will be actual volume removed within following limits:
 - .1 Width for trench excavation as indicated.
 - .2 Width for excavation for structures as indicated.
 - .3 Depth from ground elevation immediately prior to excavation, to elevation as indicated or as directed by Departmental Representative.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C117, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-63, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
 - .5 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 - .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001, Cementitious Materials for Use in Concrete.
 - .2 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .4 U.S. Environmental Protection Agency (EPA)/Office of Water

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

1.4 DEFINITIONS

- .1 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3 Topsoil:
 - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
 - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .7 Unsuitable materials:
 - .1 Weak, chemically unstable, and compressible materials.
 - .2 Frost susceptible materials.
- .8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality Control:
 - .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.
 - .2 Submit to Departmental Representative written notice at least 7 days prior to excavation work, to ensure cross sections are taken.
 - .3 Submit to Departmental Representative written notice when bottom of excavation is reached.
 - .4 Submit to Departmental Representative testing and inspection results as described in PART 3 of this Section.
- .3 Preconstruction Submittals:
 - .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.

- .2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field and clearance record from utility authority and location plan of relocated and abandoned services, as required.

1.6 QUALITY ASSURANCE

- .1 Qualification Statement: submit proof of insurance coverage for professional liability.
- .2 Submit design and supporting data at least 2 weeks prior to beginning Work.
- .3 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.
- .4 Keep design and supporting data on site.
- .5 Engage services of qualified professional Engineer who is registered or licensed in Province of Ontario, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.
- .6 Do not use soil material until written report of soil test results are reviewed and approved by Departmental Representative.
- .7 Health and Safety Requirements:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert excess aggregate materials from landfill as directed by Departmental Representative.

1.8 EXISTING CONDITIONS

- .1 Examine archaeology report entitled Braun, G.V. 2015. “Archaeological Overview Assessment: North Welcome Area Infrastructure Development.” Report on file: Parks Canada Agency.
- .2 Buried services:
 - .1 Before commencing work establish location of buried services on and adjacent to site.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
 - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
 - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .5 Prior to beginning excavation Work, Contractor is to notify applicable Departmental Representative and establish location and state of use of buried utilities and structures. Departmental Representative to clearly mark such locations to prevent disturbance during Work.

- .6 Confirm locations of buried utilities by careful test excavations or soil hydrovac methods.
- .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
- .8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing.
- .9 Record location of maintained, re-routed and abandoned underground lines.
- .10 Confirm locations of recent excavations adjacent to area of excavation.
- .3 Existing buildings and surface features:
 - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
 - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative
 - .3 Where required for excavation, cut roots or branches as directed by Departmental Representative in accordance with Section 32 01 90.33 - Tree and Shrub Preservation.

Part 2 Products

2.1 MATERIALS

- .1 Type 1 and Type 2 fill: properties to the following requirements:
 - .1 Crushed, pit run or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C136 ASTM C117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
 - .3 Table:

Sieve Designation	% Passing	
Type 1	Type 2	
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10

- .2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

- .3 Unshrinkable fill: proportioned and mixed to provide:
 - .1 Maximum compressive strength of 0.4 MPa at 28 days.
 - .2 Maximum cement content of 25 kg/m³ with 40 by volume fly ash replacement: to CSA-A3001, Type GU.
 - .3 Minimum strength of 0.07 MPa at 24 h.
 - .4 Concrete aggregates: to CSA-A23.1/A23.2.
 - .5 Cement: Type GU.
 - .6 Slump: 160 to 200 mm.
- .4 Geotextiles: to Section 31 32 19.01 - Geotextiles.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly in accordance with Section 02 41 13 - Selective Site Demolition.

3.3 PREPARATION/PROTECTION

- .1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

3.4 STRIPPING OF TOPSOIL

- .1 Begin topsoil stripping of areas as indicated after area has been cleared of brush, weeds, grasses and removed from site.

- .2 Strip topsoil to depths as directed by Departmental Representative.
 - .1 Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed by Departmental Representative.
 - .1 Stockpile height not to exceed 2 m and should be protected from erosion.
- .4 Dispose of unused topsoil off site.

3.5 STOCKPILING

- .1 Stockpile fill materials in areas designated by Departmental Representative.
 - .1 Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.6 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Construct temporary Works to depths, heights and locations as indicated and directed by Departmental Representative.
- .3 During backfill operation:
 - .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
 - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
 - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.
- .4 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- .5 Upon completion of substructure construction:
 - .1 Remove cofferdams, shoring and bracing.
 - .2 Remove excess materials from site and restore watercourses as directed by Departmental Representative.

3.7 EXCAVATION

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.
- .2 Excavate to lines, grades, elevations and dimensions as indicated.
- .3 Remove obstructions encountered during excavation in accordance with Section 02 41 13 - Selective Site Demolition.
- .4 Excavation must not interfere with bearing capacity of adjacent foundations.
- .5 Do not disturb soil within branch spread of trees or shrubs that are to remain.

- .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .6 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .7 Restrict vehicle operations directly adjacent to open trenches.
- .8 Dispose of surplus and unsuitable excavated material off site.
- .9 Do not obstruct flow of surface drainage or natural watercourses.
- .10 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .11 Notify Departmental Representative when bottom of excavation is reached.
- .12 Obtain Departmental Representative approval of completed excavation.
- .13 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.

3.8 BACKFILLING

- .1 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .2 Do not use backfill material which is frozen or contains ice, snow or debris.
- .3 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

3.9 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 21 - Construction/Demolition Waste Management and Disposal, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Replace topsoil as directed by Departmental Representative.
- .3 Reinstate lawns to elevation which existed before excavation.
- .4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstate areas affected by Work as directed by Departmental Representative.
- .6 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Approved: 2014-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 93 43.01 - Tree Pruning
 Section 31 11 00 - Clearing and Grubbing

1.2 REFERENCES

- .1 Definitions:
 - .1 Mycorrhiza: association between fungus and roots of plants. This symbiosis, enhances plant establishment in newly landscaped and imported soils.
- .2 Reference Standards:
 - .1 ASTM International
 - .1 ASTM A1064/A1064M-13, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - .2 CSA Group
 - .1 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
 - .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .2 Fertilizers Act (R.S. 1985, c. F-10).
 - .3 Fertilizers Regulations (C.R.C., c. 666).
 - .4 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
 - .4 Health Canada - Pest Management Regulatory Agency (PMRA)
 - .1 National Standard for Pesticide Education, Training and Certification in Canada (1995).
 - .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Scheduling:
 - .1 Obtain approval from Departmental Representative of schedule indicating beginning of Work.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for tree and shrub preservation materials and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit monthly written reports on maintenance during warranty period, to Departmental Representative identifying:
 - .1 Maintenance work carried out.
 - .2 Development and condition of plant material.
 - .3 Preventative or corrective measures required which are outside Contractor's responsibility.
- .3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect tree and shrub preservation materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.6 MAINTENANCE DURING WARRANTY PERIOD

- .1 From time of acceptance by Departmental Representative to end of warranty period, perform following maintenance operations.
 - .1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.
 - .2 Apply pesticides in accordance with National Standard for Pesticide Education, Training and Certification in Canada, Federal, Provincial and Municipal regulations as and when required to control insects, fungus and disease. Obtain product approval from Departmental Representative prior to application.
 - .3 Apply fertilizer in early spring at manufacturer's suggested rate.
 - .4 Remove dead, broken or hazardous branches from plant material and dispose of debris offsite.

Part 2 Products

2.1 MATERIALS

- .1 Fill:

- .1 Type (A): clean, natural river sand and gravel material, free from silt, clay, loam, friable or soluble materials and organic matter.
- .2 Type (B): excavated soil, free from roots, rocks larger than 75 mm, building debris, and toxic ingredients (salt, oil, etc). Excavated material shall be approved by Departmental Representative before use as fill.
- .2 Coarse washed stones: 35-75 mm diameter clean round hard stone.
- .3 Drintile: 100 mm diameter corrugated HDPE perforated tubing complete with snap couplings. Fill vents with 20 mm clear stone.
- .4 Peatmoss:
 - .1 Derived from partially decomposed species of Sphagnum Mosses.
 - .2 Elastic and homogeneous.
 - .3 Free of wood and deleterious material which could prohibit growth.
 - .4 Shredded minimum particle size: 5 mm.
- .5 Fertilizer:
 - .1 To Canada Fertilizer Act and Fertilizers Regulations.
 - .2 Complete, commercial, slow release with 35% of nitrogen content in water-insoluble form.
- .6 Anti-desiccant: commercial, wax-like emulsion.
- .7 Filter Cloth:
 - .1 Type 1: 100 % non-woven needle punched polyester, 2.75 mm thick, 240 g/m² mass.
 - .2 Type 2: biodegradable burlap.
- .8 Cedar posts: 150 DIA x 2400 mm length, steel T-bars 2400 mm length.
- .9 Welded wire fabric (WWF): 100 x 100 mm.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for tree and shrub preservation installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 IDENTIFICATION AND PROTECTION

- .1 Identify plants and limits of root systems to be preserved as approved by Departmental Representative.
- .2 Protect plant and root systems from damage, compaction and contamination resulting from construction as approved by Departmental Representative.
- .3 Ensure no pruning is done inside drip line. If pruning inside drip line is required consult an arborist or Canadian Certified Horticultural Technician (CCHT) as approved by Departmental Representative.

3.3 ROOT CURTAIN SYSTEM

- .1 Identify limits for required construction excavation as approved by Departmental Representative.
- .2 Prior to construction excavation, dig trench minimum 500 mm wide x 1500 mm deep, along perimeter of excavation limits.
- .3 Prune exposed roots cleanly at side of trench nearest plants to be preserved. Pruned ends to point obliquely downwards.
- .4 Install wooden posts and welded wire fabric against construction edge of trench.
- .5 Securely attach Type 2 filter fabric on plant side of wire mesh.
- .6 Prepare homogeneous mixture of fertilizer, parent material and organic matter.
 - .1 Add organic matter to mixture to achieve 7-9% organic matter content by weight.
 - .2 Incorporate with mixture grade 2:12:8 ratio fertilizer (dry) at rate of 1.5 kg/m³.
- .7 Backfill with homogeneous mixture between curtain wall and plants to be preserved in layers not exceeding 150 mm in depth. Compact each layer to 85% Standard Proctor Density.
- .8 Protect root curtain from damage during construction operations.
- .9 Water plants and root curtain sufficiently during construction to maintain optimum soil moisture condition until backfill operations are complete.
- .10 Remove root curtain during backfill operations.

3.4 AIR LAYERING SYSTEM

- .1 Using manual methods, carefully remove turf, plants, leaves, and organic matter in area of root system, dispose of plant matter offsite and slightly loosen topsoil surface. Avoid damage to root system.
- .2 Lay horizontal system of perforated [recycled content] drain pipe on surface of existing grade.
 - .1 Slope drain tile minimum 2% for drainage away from trunk of tree.
 - .2 Connect system with general site drainage system or drain to low point on site.

- .3 Install plastic vent pipes vertically over joints in horizontal pipe system or where indicated. Top of vent pipe to be 20 mm above finished grade of fill. Keep top of vent pipe covered during construction.
- .4 Cover joints with Type 1 filter fabric and place coarse washed stone around joints and vertical pipes to secure their position.
- .5 Construct drywell around trunk of tree.
 - .1 Ensure open ends of horizontal pipe system and vertical vent pipes are left exposed for air circulation to root system.
 - .2 Protect openings from blockage during construction.
 - .3 Install protective caps on exposed horizontal openings.
- .6 Place 200 mm depth of coarse washed stone on surface of original ground and horizontal pipe system to limits.
- .7 Place Type 1 filter fabric over surface of granular layer.
- .8 Place Type A fill over filter fabric to required depth without disturbing or damaging drain pipe system. Avoid damage to filter fabric.
- .9 Complete topsoil and sodding and/or finished paving over area of sub-surface system within 1 week of placing fill.
- .10 Remove temporary protective covering from vent pipe openings. Install protective caps flush with finished grade.

3.5 TRENCHING AND TUNNELING FOR UNDERGROUND SERVICES

- .1 Centre line location and limits of trench/tunnel excavation to be approved by Departmental Representative prior to excavation. Tunnel excavation to extend 2000 mm from edge of trunk on either side.
- .2 Excavate manually within zone of root system. Do not sever roots greater than 40 mm diameter except at greater than 500 mm below existing grade. Protect roots, and cut roots cleanly with sharp disinfected tools.
- .3 Excavate tunnel under centre of tree trunk using methods and equipment approved by Departmental Representative.
- .4 Minimum acceptable depth to top of tunnel: 1000 mm.
- .5 Backfill for tunnel and trench to 85% Standard Proctor Density. Avoid damage to trunk and roots of tree.
- .6 Complete tunnelling and backfilling at tree within 2 weeks of beginning Work.

3.6 LOWERING GRADE AROUND EXISTING TREE

- .1 Begin Work in accordance with schedule approved by Departmental Representative.
- .2 Cut slope not less than 500mm from tree trunk to new grade level.
- .3 Excavate to depths as indicated. Protect from damage root zone which is to remain.
- .4 When severing roots at excavation level, cut roots with sharp tools.

- .5 Cultivate excavated surface manually to 15 mm depth.
- .6 Prepare homogeneous soil mixture consisting by volume of:
 - .1 60% excavated soil cleaned of roots, plant matter, stones, debris.
 - .2 25% coarse, clean sterile sand.
 - .3 15% organic matter.
 - .4 Grade 2:12:8 fertilizer at rate of 1.5 kg/m³.
- .7 Place soil mixture over area of excavation to finished grade level. Compact to 85% Standard Proctor Density.
- .8 Water entire root zone to optimum soil moisture level.
- .9 Install surface cover of seeding in accordance with Section 32 92 19.16 - Hydraulic Seeding.

3.7 PRUNING

- .1 Prune in accordance with Section 32 93 43.01 - Tree Pruning.
- .2 Prune crown to compensate for root loss while maintaining general form and character of plant. Dispose of debris offsite.

3.8 ANTI-DESICCANT

- .1 Apply anti-desiccant to foliage where applicable and as directed by [Departmental Representative].

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools, and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Approved: 2011-06-30

Part 1 General

1.1 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

- .1 Departmental Representative to supply granular base material at pit barrow stockpile.

1.2 RELATED REQUIREMENTS

- .1 Section 32 12 16 - Asphalt Paving
 Section 32 16 15 - Concrete Walks, Curbs, and Gutters
 Section 32 15 40 - Crushed Stone Surfacing

1.3 MEASUREMENT AND PAYMENT

- .1 Measure granular base in tonnes and truck box measurement of material incorporated into Work and accepted in writing by Departmental Representative.

1.4 REFERENCES

- .1 ASTM International
 - .1 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .5 ASTM D1557-09, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .6 ASTM D1883-07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .7 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

- .2 Storage and Handling Requirements:
 - .1 Stockpile minimum 50% of total aggregate required prior to beginning operation.
 - .2 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .3 Replace defective or damaged materials with new.
 - .4 Store cement in weathertight bins or silos that provide protection from dampness and easy access for inspection and identification of each shipment.

Part 2 Products

2.1 MATERIALS

- .1 Granular base: material in accordance with the following requirements:
 - .1 Crushed stone or gravel.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1 and CAN/CGSB-8.2.
 - .1 Gradation Method #1 to:

Sieve Designation	% Passing		
(1)	(2)	(3)	
100 mm	-	-	-
75 mm	-	-	-
50 mm	100	-	-
37.5 mm	70-100	-	-
25 mm	-	100	-
19 mm	50-75	-	100
12.5 mm	-	65-100	70-100
9.5 mm	40-65	-	-
4.75 mm	30-50	35-60	40-70
2.00 mm	-	22-45	23-50
0.425 mm	10-30	10-25	7-25
0.180 mm	-	-	-
0.075 mm	3-8	3-8	3-8

- .2 Material to level surface depressions to meet gradation (2) limits in accordance with Method #1.
- .3 Liquid limit: to ASTM D4318, maximum 25
- .4 Plasticity index: to ASTM D4318, maximum 6.
- .5 Los Angeles degradation: to ASTM C131. Max. % loss by weight: 45
- .6 Crushed particles: at least 60 % of particles by mass within each of following sieve designation ranges to have at least 1 freshly fractured face. Material to be divided into ranges using methods of ASTM C136.

Passing	Retained on	
50 mm	to	25 mm
25 mm	to	19.0 mm
19.0 mm	to	4.75 mm

- .7 Soaked CBR: to ASTM D1883, minimum 80, when compacted to 100% of ASTM D1557.

Part 3 Execution

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PLACEMENT AND INSTALLATION

- .1 Place granular base after subgrade surface is inspected and approved in writing by Departmental Representative.
- .2 Placing:
 - .1 Construct granular base to depth and grade in areas indicated.
 - .2 Ensure no frozen material is placed.
 - .3 Place material only on clean unfrozen surface, free from snow and ice.
 - .4 Begin spreading base material on crown line or on high side of one-way slope.
 - .5 Place material using methods which do not lead to segregation or degradation of aggregate.
 - .6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
 - .7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
 - .1 Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
 - .8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
 - .9 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment:
 - .1 Ensure compaction equipment is capable of obtaining required material densities.
 - .2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Departmental Representative before use.
 - .3 Equipped with device that records hours of actual work, not motor running hours.

- .4 Compacting:
 - .1 Compact to density not less than 98 % maximum dry density to ASTM D698.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compacting to obtain specified density.
 - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved in writing by Departmental Representative.
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- .5 Proof rolling:
 - .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.
 - .2 Obtain written approval from Departmental Representative to use non standard proof rolling equipment.
 - .3 Proof roll at level in granular base as indicated.
 - .1 If use of non standard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.
 - .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
 - .5 Where proof rolling reveals areas of defective subgrade:
 - .1 Remove base, sub-base and subgrade material to depth and extent as directed by Departmental Representative.
 - .2 Backfill excavated subgrade with sub-base material and compact in accordance with this Section.
 - .3 Replace base material and compact in accordance with this Section.
 - .6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace with new materials in accordance with this Section at no extra cost.

3.3 SITE TOLERANCES

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.5 PROTECTION

- .1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative.

END OF SECTION

Approved: 2011-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 11 23 - Aggregate Base Courses.

1.2 MEASUREMENT AND PAYMENT

- .1 Measure asphalt concrete paving in tonnes of asphalt concrete actually incorporated into Work.
- .2 Measure supply of asphalt cement in tonnes.
- .3 Measure supply of hydrated lime in tonnes.

1.3 REFERENCES

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO M320-10, Standard Specification for Performance Graded Asphalt Binder.
 - .2 AASHTO R29-02, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
 - .3 AASHTO T245-97(2004), Standard Method of Test for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.
- .2 Asphalt Institute (AI)
 - .1 AI MS-2-1994 Sixth Edition, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- .3 ASTM International
 - .1 ASTM C88-05, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C117-04, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C123-04, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C127-07, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .5 ASTM C128-07a, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .6 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM C207-2006, Standard Specification for Hydrated Lime for Masonry Purposes.

- .9 ASTM D995-95b(2002), Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
- .10 ASTM D2419-09, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- .11 ASTM D3203-94(2005), Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
- .12 ASTM D4791-05e1, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt mixes and aggregate and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 4 weeks prior to beginning Work.
 - .2 Submit samples of following materials proposed for use 2 weeks prior to beginning Work.
 - .1 One 5 L container of asphalt cement.
 - .2 1 kg of hydrated lime.
- .4 Test and Evaluation Reports:
- .5 Certificates:
 - .1 Certification to be marked on pipe.
- .6 Test and Evaluation Reports:
 - .1 Submit manufacturer's test data and certification that asphalt cement meets specification requirements.
 - .2 Submit manufacturer's test data and certification that hydrated lime meets specified requirements.
 - .3 Submit asphalt concrete mix design and trial mix test results to Departmental Representative for approval at least 2 weeks prior to beginning Work.
 - .4 Submit printed record of mix temperatures at end of each day.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

- .2 Deliver and stockpile aggregates in accordance with Section 32 11 23 Aggregate Base Courses and erosion and sedimentation control plan. Stockpile minimum 50 % of total amount of aggregate required before beginning asphalt mixing operation.
- .3 When necessary to blend aggregates from one or more sources to produce required gradation, do not blend in stockpiles.
- .4 Stockpile fine aggregate separately from coarse aggregate, although separate stockpiles for more than two mix components are permitted.
- .5 Provide approved storage, heating tanks and pumping facilities for asphalt cement.
- .6 Submit to Departmental Representative copies of freight and waybills for asphalt cement as shipments are received.
 - .1 Departmental Representative reserves right to check weights as material is received.

Part 2 Products

2.1 MATERIALS

- .1 Performance graded asphalt cement: to AASHTO M320, grade PG 58 28 when tested to AASHTO R29.
- .2 Aggregates: in accordance with requirements as follows:
 - .1 Crushed stone or gravel.
 - .2 Gradations: within limits specified when tested to ASTM, C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.
 - .3 Table:

Sieve Designation	% Passing		
Lower Course	Surface Course	Sheet Asphalt	
200 mm	-	-	-
75 mm	-	-	-
50 mm	-	-	-
38.1 mm	-	-	-
25 mm	100	-	-
19 mm	-	-	-
12.5 mm	70-85	100	-
9.5 mm	-	-	100
4.75 mm	40-65	55-75	85-100
2.00 mm	30-50	35-55	80-95
0.425 mm	15-30	15-30	40-70
0.180 mm	5-20	5-20	10-35
0.075 mm	3-8	3-8	4-14

- .4 Coarse aggregate: aggregate retained on 4.75 mm sieve and fine aggregate is aggregate passing 4.75 mm sieve when tested to ASTM C136.
- .5 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75 mm sieve and stockpile separately from coarse aggregate.
- .6 Separate stockpiles for coarse and fine aggregates not required for sheet asphalt.

- .7 Do not use aggregates having known polishing characteristics in mixes for surface courses.
- .8 Sand equivalent: ASTM D2419. Min: 50.
- .9 Magnesium Sulphate soundness: to ASTM C88. Max % loss by mass:
 - .1 Coarse aggregate surface course: 12 %.
 - .2 Coarse aggregate lower course: 12 %.
 - .3 Fine aggregate, surface course: 16 %.
 - .4 Fine aggregate, lower course: 16 %.
- .10 Los Angeles degradation: Grading B, to ASTM C131. Max % loss by mass:
 - .1 Coarse aggregate, surface course: 25 %.
 - .2 Coarse aggregate, lower course: 35 %.
- .11 Absorption: to ASTM C127. Max % by mass:
 - .1 Coarse aggregate, surface course: 1.75 %.
 - .2 Coarse aggregate, lower course: 2.00 %.
- .12 Loss by washing: to ASTM C117. Max % passing 0.075 mm sieve:
 - .1 Coarse aggregate, surface course: 1.5 %.
 - .2 Coarse aggregate, lower course: 2.0 %.
- .13 Lightweight particles: to ASTM C123. Max % by mass less than 1.95 relative density:
 - .1 Surface course: 1.5 %.
 - .2 Lower course: 3.0 %.
- .14 Flat and elongated particles: to ASTM D4791, (with length to thickness ratio greater than 5): Max % by mass:
 - .1 Coarse aggregate, surface course: 15 %.
 - .2 Coarse aggregate, lower course: 15 %.
- .15 Crushed fragments: at least 60 % of particles by mass within each of following sieve designation ranges, to have 1 minimum freshly fractured face. Material to be divided into ranges, using methods of ASTM C136.

Passing	Retained on	
25 mm	to	12.5 mm
12.5 mm	to	6 mm

- .16 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.
- .3 Mineral filler:
 - .1 Ensure finely ground particles of limestone, hydrated lime, Portland cement or non-plastic mineral matter approved by Departmental Representative are thoroughly dry and free from lumps.
 - .2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed by Departmental Representative to improve mix properties.
 - .3 Ensure mineral filler is dry and free flowing when added to aggregate.
- .4 Anti-stripping agent: hydrated lime to ASTM C207 type N.

- .1 Add lime at rate of approximately 2-3 % of dry weight of aggregate.
- .5 Water: to approval of Departmental Representative.

2.2 EQUIPMENT

- .1 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: minimum of 3 per paver of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers:
 - .1 Drum diameter: 1200 mm minimum.
 - .2 Amplitude of vibration (machine setting): 0.5 mm maximum for lifts less than 40 mm thick.
- .4 Haul trucks: sufficient number and of adequate size, speed, and condition to ensure orderly and continuous operation and as follows:
 - .1 Boxes with tight metal bottoms.
 - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
 - .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
 - .4 Use only trucks which can be weighed in single operation on scales supplied.
- .5 Hand tools:
 - .1 Lutes or rakes with covered teeth for spreading and finishing operations.
 - .2 Tamping irons having mass 12 kg minimum and bearing area not exceeding 310 cm² for compacting material along curbs, gutters, and other structures inaccessible to roller. Mechanical compaction equipment, when approved by, may be used instead of tamping irons.
 - .3 Straight edges, 4.5 m in length, to test finished surface.
- .6 Plant testing facility: provide laboratory space at plant site for exclusive use of Departmental Representative, for performing tests, keeping records, and making reports.

2.3 MIX DESIGN

- .1 Mix design to be approved in writing by Departmental Representative.
- .2 Mix design to be developed by testing laboratory approved in writing by Departmental Representative.
- .3 Design of mix: by Marshall method to requirements below.
 - .1 Compaction blows on each face of test specimens: 50] 75.
 - .2 Mix physical requirements:

Property	Airfield Pavements	Roads	Sheet Asphalt
Marshall Stability at 60 degrees C kN min	7.0	5.5 surface course/4.5 lower course	3.0
Flow Value mm	2-4	2-4	2-5
Air Voids in Mixture,	3-5	3-5 surface course/2-6	3-5

%		lower course	
Voids in Mineral Aggregate, % min	15 surface course/13 lower course	15 surface course/13 lower course	16
Index of Retained Stability % minimum	75	75	75

- .3 Measure physical requirements as follows:
 - .1 Marshall load and flow value: to AASHTO T245.
 - .2 Compute void properties on basis of bulk specific gravity of aggregate to ASTM C127 and ASTM C128. Make allowance for volume of asphalt absorbed into pores of aggregate.
 - .3 Air voids: to ASTM D3203.
 - .4 Voids in mineral aggregates: to AI MS2.
 - .5 Index of Retained Stability: measure in accordance with Section 32 12 10 - Marshall Immersion Test for Bitumen.
- .4 Do not change job-mix without prior approval of Departmental Representative. When change in material source proposed, new job-mix formula to be approved Departmental Representative.
- .5 Return plant dust collected during processing to mix in quantities acceptable to Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt paving in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PLANT AND MIXING REQUIREMENTS

- .1 Batch and continuous mixing plants:
 - .1 To ASTM D995.
 - .2 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders.
 - .1 Do not load frozen materials into bins.
 - .3 Feed cold aggregates to plant in proportions to ensure continuous operations.
 - .4 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.

- .5 Before mixing, dry aggregates to moisture content not greater than 1 % by mass or to lesser moisture content if required to meet mix design requirements. Heat to temperature required to meet mixing temperature as directed by Departmental Representative.
- .6 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job-mix requirements.
- .7 Store hot screened aggregates in manner to minimize segregation and temperature loss.
- .8 Heat asphalt cement and aggregate to mixing temperature directed by Departmental Representative. Do not heat asphalt cement above maximum temperature indicated on temperature-viscosity chart 160 degrees C.
- .9 Make available current asphalt cement viscosity data at plant. With information relative to viscosity of asphalt being used, Departmental Representative to review temperature of completed mix at plant and at paver after considering hauling and placing conditions.
- .10 Maintain temperature of materials within 5 degrees C of specified mix temperature during mixing.
- .11 Mixing time:
 - .1 In batch plants, both dry and wet mixing times as directed by Departmental Representative. Continue wet mixing as long as necessary to obtain thoroughly blended mix but not less than 30s or more than 75s.
 - .2 In continuous mixing plants, mixing time as directed by Departmental Representative but not less than 45s.
 - .3 Mixing time as directed by Departmental Representative.
- .2 Dryer drum mixing plant:
 - .1 To ASTM D995.
 - .2 Load aggregates from individual stockpiles to separate cold feed bins. Do not load frozen materials into bins.
 - .3 Feed aggregates to burner end of dryer drum by means of multi-bin cold feed unit and blend to meet job-mix requirements by adjustments of variable speed feed belts and gates on each bin.
 - .4 Allow for easy calibration of weighing systems for aggregates without having material enter mixer.
 - .5 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.
 - .1 Calibrate weigh bridge on charging conveyor by weighing amount of aggregate passing over weigh bridge in set amount of time.
 - .2 Difference between this value and amount shown by plant computer system to differ by not more than plus or minus 2 %.
 - .6 Make provision for conveniently sampling full flow of materials from cold feed.
 - .7 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate from cold feed prior to entering drum.
 - .8 Provide system interlock stop on feed components if either asphalt or aggregate from bin stops flowing.

- .9 Accomplish heating and mixing of asphalt mix in approved parallel flow dryer-mixer in which aggregate enters drum at burner end and travels parallel to flame and exhaust gas stream.
 - .1 Control heating to prevent fracture of aggregate or excessive oxidation of asphalt.
 - .2 Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with printing recorder that can be monitored by plant operator.
 - .3 Submit printed record of mix temperatures at end of each day.
- .10 Ensure mixing period and temperature to produce uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves mixer is [2] % maximum.
- .3 Temporary storage of hot mix:
 - .1 Provide mix storage of sufficient capacity to permit continuous operation and designed to prevent segregation.
 - .2 Do not store asphalt mix in storage bins in excess of 3 hours.
- .4 While producing asphalt mix for this Project, do not produce mix for other users unless separate storage and pumping facilities are provided for materials supplied to this project.
- .5 Mixing tolerances:
 - .1 Permissible variation in aggregate gradation from job mix (percent of total mass).

4.75 mm sieve and larger	
2.00 mm sieve	
0.425 mm sieve	
0.180 mm sieve	
0.075 mm sieve	2.0

- .2 Permissible variation of asphalt cement from job mix: 0.25%.
- .3 Permissible variation of mix temperature at discharge from plant: 5 degrees C.
- .6 Addition of anti-stripping agent:
 - .1 Plant to be equipped with pug mill to thoroughly mix aggregates and lime prior to entering the plant.
 - .2 Plant to be equipped with suitable conveyor systems capable of supplying aggregates and lime at constant rate.
 - .3 Plant and equipment used for addition of lime to be equipped with covers to control loss of lime.
 - .4 Plant to be equipped to control rate of lime incorporation to within 1/4%.
 - .5 Add water to aggregate prior to entering pug mill.
 - .6 Add water to lime sufficiently in advance to permit time to slake prior to entering pug mill.

3.3 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Prior to laying mix, clean surfaces of loose and foreign material.

3.4 TRANSPORTATION OF MIX

- .1 Transport mix to job site in vehicles cleaned of foreign material.
- .2 Paint or spray truck beds with limewater, soap or detergent solution, or non petroleum based commercial product, at least daily or as required.
 - .1 Raise truck bed and thoroughly drain, and ensure no excess solution remains in truck bed.
- .3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves artificial light for night placing.
- .4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation.
 - .1 Do not dribble mix into trucks.
- .5 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.
- .6 Deliver loads continuously in covered vehicles and immediately spread and compact.
 - .1 Deliver and place mixes at temperature within range as directed by Departmental Representative, but not less than 135 degrees C.

3.5 TEST STRIP

- .1 Construct and test test strip to approval of Departmental Representative.
- .2 For airfield pavement, construct test strip in non-critical area to resolve anticipated problems with equipment, mix behaviour or compaction, prior to starting paving operation.
- .3 Construct test strip with at least 500 tonnes of mix, and involving more than one lane, so that joint finishing techniques can be established.
- .4 During construction of test strip, Departmental Representative will establish optimum rolling pattern by taking nuclear densimeter readings and observations to:
 - .1 Determine sequence and number of passes.
 - .2 Determine correct operating characteristics of vibratory rollers.
 - .3 Determine maximum density of asphalt mix.
 - .4 Ensure smooth surface finish.
 - .5 Establish actual density achieved by coring in order to determine if additional or other rolling equipment is required to achieve density of not less than 98 % of

density obtained with Marshall specimens prepared from samples of mix being used.

3.6 PLACING

- .1 Obtain Departmental Representative's approval of base prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses, grades and lines as indicated Departmental Representative.
- .3 Placing conditions:
 - .1 Place asphalt mixtures only when air temperature is 5 degrees C minimum.
 - .2 When temperature of surface on which material is to be placed falls below 10 degrees C, provide extra rollers as necessary to obtain required compaction before cooling.
 - .3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
- .4 Place asphalt concrete in compacted lifts of thickness as follows:
 - .1 Levelling courses to thicknesses required but not exceeding 50 mm.
 - .2 Sheet asphalt course in one layer of 40 mm.
- .5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.
- .6 Place individual strips no longer than 500 m.
- .7 On airport runways and taxiways, aprons and parking lots commence spreading at high side of pavement or at crown and span crowned centerlines with initial strip.
- .8 Spread and strike off mixture with self propelled mechanical finisher.
 - .1 Construct longitudinal joints and edges true to line markings.
 - .1 Departmental Representative to establish lines for paver to follow parallel to centerline of proposed pavement. Position and operate paver to follow established line closely.
 - .2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver.
 - .1 Work pavers as close together as possible and in no case permit them to be more than 30 m apart.
 - .3 Maintain constant head of mix in auger chamber of paver during placing.
 - .4 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
 - .5 Correct irregularities in alignment left by paver by trimming directly behind machine.
 - .6 Correct irregularities in surface of pavement course directly behind paver.
 - .1 Remove excess material forming high spots using shovel or lute.
 - .1 Fill and smooth indented areas with hot mix.
 - .2 Do not broadcast material over such areas.
 - .7 Do not throw surplus material on freshly screeded surfaces.

- .9 When hand spreading is used:
 - .1 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section.
 - .1 Use measuring blocks and intermediate strips to aid in obtaining required cross-section.
 - .2 Distribute material uniformly without broad casting material.
 - .3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes.
 - .1 Reject material that has formed into lumps and does not break down readily.
 - .4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.
 - .5 Provide heating equipment to keep hand tools free from asphalt.
 - .1 Control temperature to avoid burning material.
 - .2 Do not use tools at higher temperature than temperature of mix being placed.

3.7 COMPACTING

- .1 Roll asphalt continuously using established rolling pattern for test strip and to density of not less than 98 % of maximum density determined for test strip.
- .2 Do not change rolling pattern unless mix changes or lift thickness changes.
 - .1 Change rolling pattern only as directed by Departmental Representative.
- .3 Roll asphalt continuously to density not less than 98 % of MTRD.
- .4 General:
 - .1 Provide at least 2 rollers and as many additional rollers as necessary to achieve specified pavement density. When more than 2 rollers are required, 1 roller must be pneumatic tired type.
 - .2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.
 - .3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/h for breakdown and intermediate rolling for static steel-wheeled and pneumatic tired rollers. Do not exceed 9 km/h for finish rolling.
 - .4 Use static compaction for levelling coarse less than 25 mm thick.
 - .5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 25 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.
 - .6 Overlap successive passes of roller by minimum of 200 mm and vary pass lengths.
 - .7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
 - .8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.

- .9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
- .10 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.
 - .1 Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.
- .11 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.
- .12 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.
- .5 Breakdown rolling:
 - .1 Begin breakdown rolling with static steel wheeled roller immediately following rolling of transverse and longitudinal joint and edges.
 - .2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.
 - .3 Operate breakdown roller with drive roll or wheel nearest finishing machine. When working on steep slopes or super-elevated sections use operation approved by Departmental Representative.
 - .4 Use only experienced roller operators.
- .6 Intermediate rolling:
 - .1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.
 - .2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.
- .7 Finish rolling:
 - .1 Accomplish finish rolling with two-axle or three-axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks.
 - .1 If necessary to obtain desired surface finish, use pneumatic-tired rollers as directed by Departmental Representative.
 - .2 Conduct rolling operations in close sequence.
- .8 Dust entire area of sheet asphalt pavements with hydrated lime immediately after rolling to eliminate tendency to pick-up under traffic.

3.8 JOINTS

- .1 General:
 - .1 Remove surplus material from surface of previously laid strip.
 - .1 Do not deposit on surface of freshly laid strip.
 - .2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.
 - .3 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.

- .2 Transverse joints:
 - .1 Offset transverse joint in succeeding lifts by at least 600 mm.
 - .2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.
 - .3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.
- .3 Longitudinal joints:
 - .1 Offset longitudinal joints in succeeding lifts by at least 150 mm.
 - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C prior to paving of adjacent lane.
 - .1 If cold joint can not be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.
 - .3 Overlap previously laid strip with spreader by 25 to 50 mm.
 - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
 - .5 Roll longitudinal joints directly behind paving operation.
 - .6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.
- .4 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix.
 - .1 Place and compact joint to ensure joint is smooth and without visible breaks in grade.
 - .2 Locate feather joints as indicated.
- .5 Construct butt joints as indicated.

3.9 FINISH TOLERANCES

- .1 Finished asphalt surface to be within 5 mm of design elevation but not uniformly high or low.
- .2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with [4.5] m straight edge placed in any direction.

3.10 DEFECTIVE WORK

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.
 - .1 If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.
- .2 Repair areas showing checking, rippling, or segregation.
- .3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

3.11 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

OF SECTION

Approved: 2009-12-31

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 11 23 – Aggregate Base Courses

1.2 MEASUREMENT AND PAYMENT

- .1 Measure granular sub-base in tonnes of material incorporated into Work and accepted by Departmental Representative.
- .2 Measure granular base in tonnes of material incorporated into Work and accepted by Departmental Representative.
- .3 Measure granular topping in tonnes of material incorporated into Work and accepted by Departmental Representative.

1.3 REFERENCES

- .1 ASTM International
 - .1 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .2 ASTM C117-04, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM D4318-05, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .4 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- .2 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
 - .2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Access: allow access to building at all times.
- .2 Scheduling: co-ordinate paving schedule to minimize interference with normal use of premises.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Store crushed stone as and where directed by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Granular sub-base: in accordance with the following requirements:
 - .1 Crushed, pit run or screened stone, gravel or sand consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
 - .2 Gradations: within limits specified when tested to ASTM C136. Sieve sizes to CAN/CGSB-8.1.
- .2 Table:

Sieve Designation	% Passing
75 mm	100
4.75 mm	25-85
0.425 mm	5-30
0.075 mm	0-10

- .3 Granular base: in accordance with the following requirements:
 - .1 Crushed stone or gravel: hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
 - .2 Gradations: within limits specified when tested to ASTM C136. Sieve sizes to CAN/CGSB-8.1.
- .3 Table:

Sieve Designation	% Passing
19 mm	100]
12.5 mm	70-100
4.75 mm	40-70
2.00 mm	23-50
0.425 mm	7-25
0.075 mm	3-8

- .4 Liquid limit: ASTM D4318 maximum 25.
- .5 Plasticity index: ASTM D4318 maximum 6.
- .4 Granular topping:
 - .1 Screenings: hard, durable, crushed stone particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
 - .2 Gradations: within limits specified when tested to ASTM C136.

Sieve Designation	% Passing
9.5 mm	100
4.75 mm	50-100
2.00 mm	30-65
0.425 mm	10-30
0.075 mm	5-10

Part 3 Execution

3.1 SUBGRADE

- .1 Ensure subgrade preparation conforms to levels and compaction required, to allow for installation of granular base.

3.2 GRANULAR SUB-BASE

- .1 Granular sub-base material minimum thickness: as indicated.
- .2 Place material in uniform layers not to exceed 150 mm compacted thickness.
 - .1 Compact layer to 98 % Standard Density in accordance with ASTM D698.

3.3 GRANULAR BASE

- .1 Granular base material thickness: as indicated.
- .2 Spread and compact granular base material in uniform layers not exceeding 100 mm compacted thickness.
- .3 Compact to a density of not less than 98 % Standard Density in accordance with ASTM D698.

3.4 GRANULAR TOPPING

- .1 Place granular topping to compacted thickness as indicated.
- .2 Place material in uniform layers not to exceed 50 mm compacted thickness.
 - .1 Compact layer to 98 % Standard Density in accordance with ASTM D698.

3.5 FIELD QUALITY CONTROL

- .1 Inspection and testing of crushed stone paving: carried out by designated testing laboratory.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.7 PROTECTION

- .1 Prevent damage to buildings, landscaping, curbs, sidewalks, trees, fences, roads and adjacent property.
 - .1 Repair damages incurred.
- .2 Provide access to building at all times. Co-ordinate paving schedule to minimize interference with normal use of premises.

END OF SECTION

Approved: 2010-12-31

Part 1 General

1.1 PRICE AND PAYMENT PROCEDURES

- .1 Measurement and Payment:
- .2 Measure application of calcium chloride in litres applied.
- .3 No extra compensation will be paid for calcium chloride ordered and applied on Saturdays, Sundays or holidays.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .1 Supply calcium chloride in quantities and at times as directed by Departmental Representative.
 - .2 Deliver calcium chloride to site in moisture-proof bags. Indicate name of manufacturer, name of product, net weight or mass, and percentage of calcium chloride guaranteed by manufacturer.
- .3 Storage and Handling Requirements:
 - .1 Store bags of calcium chloride in weather-proof enclosures.

Part 2 Products

2.1 MATERIALS

- .1 Calcium chloride, Type I: to CAN/CGSB-15.1, 35% aqueous solution.

Part 3 Execution

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings.

3.2 APPLICATION

- .1 Apply calcium chloride with equipment approved by Departmental Representative at rate of 1.3 L/m² for liquid when directed by Departmental Representative.

- .2 Apply aqueous calcium chloride with distributors equipped with means of shut-off and with spray system to ensure uniform application.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Approved: 2006-12-31

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 11 23 - Aggregate Base Courses
 Section 31 10 00 - Concrete Forming and Accessories
 Section 31 20 00 - Concrete Reinforcing

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C117-04, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D260-86(2001), Standard Specification for Boiled Linseed Oil.
 - .4 ASTM D698-00ae1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600 kN-m/m³).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-3.3-99(March 2004), Kerosene, Amend. No. 1, National Standard of Canada.
 - .2 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Inform Departmental Representative of proposed source of materials and provide access for sampling at least 4 weeks prior to commencing work.

Part 2 Products

2.1 MATERIALS

- .1 Concrete mixes and materials: in accordance with drawing details.
- .2 Reinforcing steel: in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 Joint filler: in accordance with drawing details.
- .4 Granular base: material to Section 32 11 23 - Aggregate Base Courses following requirements:

- .1 Type 1, 2 or 3 fill.
- .2 Crushed stone or gravel.
- .3 Gradations: within limits specified when tested to ASTM C136. Sieve sizes to CAN/CGSB-8.1.
- .5 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.
- .6 Fill material: to Section 32 11 23 - Aggregate Base Courses following requirements:
 - .1 Type 1, 2 or 3 fill.
 - .2 Crushed stone or gravel.
 - .3 Gradations: within limits specified when tested to ASTM C136. Sieve sizes to CAN/CGSB-8.1.
- .7 Boiled linseed oil: to ASTM D260.
- .8 Kerosene: to CAN/CGSB-3.3.

Part 3 Execution

3.1 GRADE PREPARATION

- .1 Do grade preparation work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Construct embankments using excavated material free from organic matter or other objectionable materials.
 - .1 Dispose of surplus and unsuitable excavated material off site.
- .3 Place fill in maximum 150 mm layers and compact to at least 98 % of maximum dry density to ASTM D698.

3.2 GRANULAR BASE

- .1 Obtain Departmental Representative approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths, and depths as indicated.
- .3 Compact granular base in maximum 150 mm layers to at least 98 % of maximum density to ASTM D698.

3.3 CONCRETE

- .1 Obtain Departmental Representative approval of granular base and reinforcing steel prior to placing concrete.
- .2 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .3 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to centre line.

3.4 TOLERANCES

- .1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

3.5 EXPANSION AND CONTRACTION JOINTS

- .1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 1.5 m.
- .2 Install expansion joints at intervals of 3 m.
- .3 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

3.6 ISOLATION JOINTS

- .1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .2 Install joint filler in isolation joints in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .3 Seal isolation joints with sealant approved by Departmental Representative.

3.7 CURING

- .1 Cure concrete by adding moisture continuously in accordance with CSA-A23.1/A23.2 to exposed finished surfaces for at least 1 day after placing, or sealing moisture in by curing compound as directed by Departmental Representative.
- .2 Where burlap is used for moist curing, place two pre-wetted layers on concrete surface and keep continuously wet during curing period.
- .3 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.

3.8 BACKFILL

- .1 Allow concrete to cure for 7 days prior to backfilling.
- .2 Backfill to designated elevations with material as directed by Departmental Representative.
 - .1 Compact and shape to required contours as indicated.

3.9 LINSEED OIL TREATMENT

- .1 Apply two coats of linseed oil mixture uniformly to surfaces of curbs, walks and gutters, after concrete has cured for specified curing time and when surface of concrete is clean and dry.
- .2 Linseed oil mixture to consist of 50% boiled linseed oil and 50% mineral spirits by volume.
- .3 Apply treatment when air temperature above 10 degrees C.
- .4 Apply first coat at 135 mL/m².

- .5 Apply second coat at 90 mL/m² when first coat has dried.

3.10 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Approved: 2014-12-31

Part 1 General

1.1 MEASUREMENT FOR PAYMENT

- .1 Pavement marking: measured by lump sum.
- .2 Supply of paint: measured in litres.

1.2 REFERENCES

- .1 Environment Canada (EC)
 - .1 Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations, SOR/2009-264.
- .2 Green Seal (GS)
 - .1 GS-11-2013, Standard for Paints and Coatings.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
 - .1 MPI #32 Traffic Markings Paint, Alkyd.
- .5 South Coast Air Quality Management District (SCAQMD)
 - .1 SCAQMD Rule 1113-13, Architectural Coatings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Samples:
 - .1 Submit to Departmental Representative following material sample quantities at least 2 weeks prior to commencing work.
 - .1 Two 1 L samples of each type of paint.
 - .2 Sampling to MPI Painting Manual.
 - .2 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, MPI specification number and formulation number and batch number.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .4 Packaging Waste Management in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 SITE CONDITIONS

- .1 Sustainable Design Provisions:
 - .1 Seasonal restriction for high VOC content traffic marking coatings.
 - .1 Traffic marking coating application between May 1st and October 15th is subject to seasonal use restriction and must not have a VOC concentration in excess of 150 g/L.

Part 2 Products

2.1 MATERIALS

- .1 Paint and Markings:
 - .1 To MPI #32, Alkyd zone/traffic marking.
 - .2 Traffic Marking Coatings: maximum VOC limit 450g/L to SOR/2009-264 Schedule 1
 - .3 Paints in accordance with MPI recommendation for surface conditions.
 - .4 Colour: to MPI listed, white.
 - .5 Upon request, Departmental Representative will supply qualified product list of paints applicable to work. Qualified paints may be used but Departmental Representative reserves right to perform further tests.
- .2 Thinner: to MPI listed manufacturer.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates and surfaces to receive pavement markings previously installed under other Sections or Contracts are acceptable for product installation in accordance with MPI instructions prior to pavement markings installation.
 - .1 Visually inspect substrate in presence of Departmental Representative.

- .2 Pavement surface: dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.
- .3 Proceed with Work only after unacceptable conditions have been rectified.

3.2 EQUIPMENT REQUIREMENTS

- .1 Paint applicator: approved pressure type mobile with positive shut-off distributor capable of applying paint in single, double and dashed lines and capable of applying marking components uniformly, at rates specified, and to dimensions as indicated.
- .2 Distributor: capable of applying reflective glass beads as overlay on freshly applied paint.

3.3 APPLICATION

- .1 Pavement markings: laid out by Departmental Representative.
- .2 Unless otherwise approved by Departmental Representative paint only when air temperature is above 10 degrees C, wind speed is less than 60 km/h and no rain is forecast within next 4hours.
- .3 Apply traffic paint evenly at rate of 3m²/L.
- .4 Do not thin paint unless approved by Departmental Representative.
- .5 Symbols and letters to dimensions indicated.
- .6 Paint lines of uniform colour and density with sharp edges.
- .7 Thoroughly clean distributor tank before refilling with paint of different colour.
- .8 Apply glass beads at rate of 0.5 kg/L of painted area immediately after application of paint.

3.4 TOLERANCE

- .1 Paint markings: within plus or minus 12 mm of dimensions indicated.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove insulation material spilled during installation and leave work area ready for application of wall board.
- .3 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

- .1 Protect pavement markings until dry.

- .2 Repair damage to adjacent materials caused by pavement marking application.

END OF SECTION

Approved: 2011-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 16 15 - Concrete Walks, Curbs, and Gutters

1.2 REFERENCES

- .1 CSA International
 - .1 CAN/CSA-Z809-08, Sustainable Forest Management.
- .2 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .3 Sustainable Forestry Initiative (SFI)
 - .1 SFI-2010-2014 Standard.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for furniture and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit shop drawings indicating dimensions, sizes, assembly, anchorage and installation details for each furnishing specified.
- .4 Sustainable Design Submittals:

1.4 QUALITY ASSURANCE

- .1 Sustainable Standards Certification:
 - .1 Certified Wood: submit listing of wood products and materials used in accordance with CAN/CSA-Z809 or FSC or SFI.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Store and protect furnishings from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan.

Part 2 Products

2.1 BENCH

- .1 Seat: Presawn rectangular hemlock logs
 - .1 CAN/CSA-Z809 or FSC or SFI certified.
 - .2 Dimensions: mm.
 - .1 Height: 450mm.
 - .2 Length: 2500mm.
 - .3 Depth: 450mm.
 - .4 Finish: Seat: Two coats of clear stain as approved by contract administrator

2.2 TRASH CONTAINER

- .1 Basic construction material: Galvanneal Steel
 - .1 Frame: Galvanneal Steel
 - .2 Dimensions: mm.
 - 1. Height: 1220mm.
 - 2. Length: 710mm.
 - 3. Depth: 685mm.
 - .3 Finish: Powder coat.

2.3 BICYCLE RACK

- .1 Basic Construction Material: pre-finished tubular steel
- .2 Dimensions: inches.
 - .1 Height: 36 ½”
 - .2 Circle Width: 2 3/8”
- .3 Finish: Powder coated

2.4 BICYCLE REPAIR STATION

- .1 Basic Construction Material: Steel
- .2 Dimensions: mm
 - .1 Height: 1500mm.
 - .2 Length: 178mm.
 - .3 Width: 76.2mm.
- .3 Finish: Hot Dipped Galvanized]

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for exterior site furnishing installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

- .1 Locate and protect utility lines.
- .2 Notify and acquire written acknowledgment from utility authorities before beginning installation Work

3.3 INSTALLATION

- .1 Assemble furnishings in accordance with manufacturer's written recommendations.
- .2 Install furnishing, true, plumb, anchored as indicated by Departmental Representative.
- .3 Touch-up damaged finishes to approval of Departmental Representative.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by site furnishings installation.

END OF SECTION

Approved: 2006-09-30

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 22 13 - Rough Grading
 Section 31 14 13 - Soil Stripping
 Section 32 93 10 - Trees, Shrubs, and Groundcover Planting

1.2 MEASUREMENT PROCEDURES

- .1 Preparation of sub-grade for placing of topsoil will not be measured for payment.
- .2 Topsoil stripping will not be measured.

1.3 PAYMENT

- .1 Testing of topsoil: Departmental Representative will pay for cost of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.

1.4 REFERENCES

- .1 Agriculture and Agri-Food Canada
 - .1 The Canadian System of Soil Classification, Third Edition, 1998.
- .2 Canadian Council of Ministers of the Environment
 - .1 PN1340-2005, Guidelines for Compost Quality.

1.5 DEFINITIONS

- .1 Compost:
 - .1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.
 - .2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.
 - .3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below (25) (50)), and contain no toxic or growth inhibiting contaminants.
 - .4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category (A) (B).

1.6 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality control submittals :
 - .1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.

- .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert unused soil amendments from landfill to official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 TOPSOIL

- .1 On site topsoil, stripped and stockpiled or left in situ and amended as required from recommendations in soil test report.
- .2 Imported topsoil for sodded and or seeded areas: friable, neither heavy clay nor of very light sandy nature consisting of 45% sand, 35% silt, 20% clay and pH of 6.2 to 7.2. Free from subsoil, roots, vegetation, debris, toxic materials, stones over 50 mm diameter, containing four percent (4%) **minimum** organic matter for clay loams and two percent (2%) **minimum** organic matter for sandy loams and must be capable of sustaining vigorous plant growth.
- .3 Imported topsoil for all planting beds: a triple mix, containing a minimum of 4% organic matter. Free from subsoil, roots, grass, weeds, toxic materials, stones, foreign objects and with an acidity range, PH, of 5.5 to 7.5. Topsoil containing crabgrass, coughgrass, or noxious weeds is not acceptable.
- .4 Planting soil:
 - .1 For planting of trees, mix topsoil with 20% peatmoss loose by volume.
 - .2 Incorporate bonemeal in to planting soil at rate of 3 KG/M3 of soil mixture.
 - .3 For special planting mixes see Section 32 93 10 Trees, Shrubs, and Groundcover Planting

2.2 SOIL AMENDMENTS

- .1 Fertilizer:
 - .1 Fertility: major soil nutrients present in following amounts:
 - .2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
 - .3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
 - .4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.

- .5 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
- .6 Ph value: 6.5 to 8.0.
- .2 Peatmoss:
 - .1 Derived from partially decomposed species of Sphagnum Mosses.
 - .2 Elastic and homogeneous, brown in colour.
 - .3 Free of wood and deleterious material which could prohibit growth.
 - .4 Shredded particle minimum size: 5 mm.
- .3 Sand: washed coarse silica sand, medium to coarse textured.
- .4 Organic matter: compost Category A in accordance with CCME PN1340, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.
- .5 Limestone:
 - .1 Ground agricultural limestone.
 - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
- .6 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

2.3 SOURCE QUALITY CONTROL

- .1 Advise Departmental Representative of sources of topsoil to be utilized with sufficient lead time for testing.
- .2 Contractor is responsible for amendments to supply topsoil as specified.
- .3 Soil testing by recognized testing facility for PH, P and K, and organic matter.
- .4 Testing of topsoil will be carried out by testing laboratory designated by Departmental Representative.
 - .1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 STRIPPING OF TOPSOIL

- .1 Begin topsoil stripping of areas as indicated by Departmental Representative after area has been cleared of brush, weeds and grasses and removed from site.
- .2 Strip topsoil to depths as indicated by Departmental Representative.
 - .1 Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.
- .3 Stockpile in locations as indicated by Departmental Representative.
 - .1 Stockpile height not to exceed 2 m.
- .4 Disposal of unused topsoil is to be in an environmentally responsible manner but not used as landfill as directed by Departmental Representative.
- .5 Protect stockpiles from contamination and compaction.

3.3 PREPARATION OF EXISTING GRADE

- .1 Verify that grades are correct.
 - .1 If discrepancies occur, notify Departmental Representative, and do not commence work until instructed by Departmental Representative.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
 - .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
 - .2 Remove debris which protrudes more than 75 mm above surface.
 - .3 Dispose of removed material off site.
- .4 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm.
 - .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.4 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

- .1 Place topsoil after Departmental Representative has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm.
- .3 For sodded areas keep topsoil 15 mm below finished grade.
- .4 Spread topsoil as indicated to following minimum depths after settlement.
 - .1 150 mm for seeded areas.
 - .2 135 mm for sodded areas.
 - .3 300 mm for flower beds.
 - .4 500 mm for shrub beds.
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.5 FINISH GRADING

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
 - .1 Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.
 - .1 Leave surfaces smooth, uniform and firm against deep footprinting.

3.6 ACCEPTANCE

- .1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.7 SURPLUS MATERIAL

- .1 Dispose of materials except topsoil not required off site.

3.8 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Approved: 2011-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 91 19.13-Topsoil Placement and Grading.

1.2 MEASUREMENT AND PAYMENT

- .1 Measure hydraulic seeding in square metres of actual surface area for:
 - .1 Grass mixture including fertilizer.
 - .2 Areas of blending into existing turf grass will not be measured for payment.
- .2 Measure maintenance during establishment period of areas seeded in square metres.
- .3 Payment for seeding made at unit price bid of actual area surface measurements taken and computed by Departmental Representative.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Scheduling:
 - .1 Schedule hydraulic seeding to coincide with preparation of soil surface.
 - .2 Schedule hydraulic seeding using grass mixtures and mixtures containing Trefoil between dates recommended by Provincial Agricultural Department.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for seed, mulch, tackifier, fertilizer, liquid soil amendments and micronutrients.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Landscape Contractor: to be a Member in Good Standing of Landscape Ontario Horticultural Trades Association.
 - .2 Landscape Planting Supervisor: Landscape Industry Certified Technician with Softscape Installation designation.
 - .3 Landscape Maintenance Supervisor: Landscape Industry Certified Technician with Turf Maintenance designation.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Labelled bags of fertilizer identifying mass in kg, mix components and percentages, date of bagging, supplier's name and lot number.
 - .2 Inoculant containers to be tagged with expiry date.
- .3 Storage and Handling Requirements:
 - .1 Store fertilizer off ground and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .5 Packaging Waste Management: remove for reuse and return pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 WARRANTY

- .1 For seeding, 12 months warranty period is extended to 1 full growing season.
- .2 End-of-warranty inspection will be conducted by Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Seed Mix: Refer to planting plan for seed mix.
- .2 Final approval of plant material and sourcing will be provided by Resource Conservation staff. The seeds must be procured from a qualified and approved producer.
- .3 Mulch: specially manufactured for use in hydraulic seeding equipment, non-toxic, water activated, green colouring, free of germination and growth inhibiting factors with following properties:
 - .1 Type I mulch:
 - .1 Made from wood cellulose fibre.
 - .2 Organic matter content: 95% plus or minus 0.5%.
 - .3 Value of pH: 6.0.
 - .4 Potential water absorption: 900%.
 - .2 Type II mulch:
 - .1 Made from raw cotton fibre and straw, processed to produce fibre lengths of 15 mm minimum and 25 mm maximum. Greater proportions of ingredients to be straw.

- .4 Tackifier: water dilutable, liquid dispersion.
- .5 Water: free of impurities that would inhibit germination and growth.
- .6 Fertilizer:
 - .1 To Canada "Fertilizers Act" and Regulations.
 - .2 Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.
- .7 Inoculants: inoculant containers to be tagged with expiry date.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for hydraulic seeding in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLERS

- .1 Use installers members in Good Standing of Landscape Ontario Horticultural Trades Association.

3.3 PROTECTION OF EXISTING CONDITIONS

- .1 Protect structures, signs, guide rails, fences, plant material, utilities and other surfaces not intended for spray.
- .2 Immediately remove any material sprayed where not intended as directed by Departmental Representative.

3.4 PREPARATION OF SURFACES

- .1 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.
- .2 Fine grade areas to be seeded free of humps and hollows.
 - .1 Ensure areas are free of deleterious and refuse materials.
- .3 Cultivated areas identified as requiring cultivation to depth of 25 mm.
- .4 Ensure areas to be seeded are moist to depth of 150 mm before seeding.
- .5 Obtain Departmental Representative's approval of grade before starting to seed.

3.5 FERTILIZING PROGRAM

- .1 Fertilize prior to fine grading applying fertilizer equally distributed in accordance with the following program:
 - .1 10-20-5 at 7kg. / 175 sq.m.
- .2 Fertilize during establishment and warranty periods applying fertilizer equally distributed in accordance with the following program:
 - .1 26-0-6 at 12kg. / 800 sq.m.

3.6 INSTALLATION

- .1 Seeding of grass shall be carried out during early spring up to June 30, or fall from Aug. 24 to Oct. 1, which are most favorable for the establishment of a healthy stand of grass. Extensions may be granted with the Landscape Architect's approval.
- .2 Rough graded soil shall be scarified to a min. depth of 75 mm to produce an even, loose textured surface, free of stones, roots, branches, etc., larger than 25 mm in diameter and live weeds.
- .3 The finished grade shall be smooth loose textured, and free of all stones, roots, branches, etc., larger than 25 mm in diameter and shall be inspected prior to commencing seeding operations.
- .4 Where specified, the topsoil mixture under all seeded areas shall be spread evenly over the approved subgrade to the specified depth and compacted to 80% to 85% Standard Proctor Density. The min. depth of topsoil under seeded areas shall be a min. of 100 mm.
- .5 All materials shall be measured accurately before being charged into the seeder, at the following rates:
 - .1 Grass seed at 168 kg/ha
 - .2 Nurse crop seed, where specified at 67 kg/ha
 - .3 Water at 5617 L./min. per ha
 - .4 Fertilizers at the specified rates
- .6 On the same day, immediately following seeding, the seeded areas shall be mulched by means of an approved mulch blower. No area shall be seeded in excess of that which can be mulched on the same day.
- .7 The mulch shall be applied at a rate sufficient to form an even uniform mat over the entire area to a depth of not less than 25 mm and not exceeding 50mm.
- .8 The asphalt emulsion shall be sprayed into the air stream of the mulch blower at a rate sufficient to form a cohesive mat, but at any rate not less than 1123 l./ha.
- .9 It shall be distributed uniformly throughout the mulching material by means of not less than two nozzles.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.

- .2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .1 Clean and reinstate areas affected by Work.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.

3.8 PROTECTION

- .1 Protect seeded areas from trespass until plants are established.
- .2 Remove protection devices as directed by Departmental Representative.

3.9 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Ensure maintenance is carried out under supervision of certified Landscape Maintenance Supervisor.
- .2 Perform following operations from time of seed application until acceptance by Departmental Representative.
- .3 Grass Mixture:
 - .1 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
 - .2 Mow grass to 50 mm whenever it reaches height of 70 mm. Remove clippings which will smother grass as directed by Departmental Representative.
 - .3 Fertilize seeded areas after 10 weeks after germination provided plants have mature true leafs in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles; water in well.
 - .4 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.
 - .5 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.

3.10 ACCEPTANCE

- .1 Seeded areas will be accepted by Departmental Representative provided that:
 - .1 Seeded areas are free of rutted, eroded, bare or dead spots.
 - .2 Areas have been mown at least twice.
 - .3 Areas have been fertilized.
- .2 Areas seeded in fall will achieve final acceptance in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

3.11 MAINTENANCE DURING WARRANTY PERIOD

- .1 Perform following operations from time of acceptance until end of warranty period:
 - .1 Repair and reseed dead or bare spots to satisfaction of Departmental Representative.
 - .2 Mow areas seeded, remove clippings that will smother grassed areas, as directed by Departmental Representative.
 - .3 Fertilize seeded areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

END OF SECTION

Approved: 2011-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 91 19.13 - Topsoil Placement and Grading

1.2 MEASUREMENT AND PAYMENT

- .1 Payment for sodding will be made at unit price bid of actual area surface measurements taken and computed by Departmental Representative for:
 - .1 Turf Grass Nursery Sod Type No. 1 per square metre.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Scheduling:
 - .1 Schedule sod laying to coincide with preparation of soil surface.
 - .2 Schedule sod installation when frost is not present in ground.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for sod and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements of seed mix, seed purity, and sod quality.
- .4 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties of seed mix, seed purity, and sod quality.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Landscape Contractor: to be a Member in Good Standing of Landscape Ontario Horticultural Trades Association.
 - .2 Landscape Planting Supervisor: Landscape Industry Certified Technician with Softscape Installation designation.
 - .3 Landscape Maintenance Supervisor: Landscape Industry Certified Technician with Turf Maintenance designation.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with supplier's recommendations.
 - .2 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan.

Part 2 Products

2.1 MATERIALS

- .1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.
 - .1 Turf Grass Nursery Sod types:
 - .1 Number One Kentucky Bluegrass Sod: Nursery Sod grown solely from seed of cultivars of Kentucky Bluegrass, containing not less than 50% Kentucky Bluegrass cultivars.
 - .2 Number One Kentucky Bluegrass Sod - Fescue Sod: Nursery Sod grown solely from seed mixture of cultivars of Kentucky Bluegrass and Chewing Fescue or Creeping Red Fescue, containing not less than 40% Kentucky Bluegrass cultivars and 30% Chewing Fescue or Creeping Red Fescue cultivars.
 - .3 Number One Named Cultivars: Nursery Sod grown from certified seed.
 - .2 Turf Grass Nursery Sod quality:
 - .1 Not more than 1 broadleaf weed and up to 1% native grasses per 40 square metres.
 - .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50 mm.
 - .3 Mowing height limit: 35 to 65 mm.
 - .4 Soil portion of sod: 6 to 15 mm in thickness.
- .2 Commercial Grade Turf Grass Nursery:
 - .1 Mow sod at height directed by Departmental Representative within 36 hours prior to lifting, and remove clippings.
 - .2 Not more than 5 broadleaf weeds and up to 20% native grasses per 40 square metres.
- .3 Sod establishment support:

- .1 Wooden pegs: 17 x 8 x 200 mm.
- .2 Biodegradable starch pegs: 17 x 8 x 200 mm.
- 4 Water:
 - .1 Supplied by Departmental Representative at designated source.
- .5 Fertilizer:
 - .1 To Canada "Fertilizers Act" and Fertilizers Regulations.
 - .2 Complete, synthetic, slow release with 65 % of nitrogen content in water-insoluble form.

2.2 SOURCE QUALITY CONTROL

- .1 Obtain written approval from Departmental Representative of sod at source.
- .2 When proposed source of sod is approved, use no other source without written authorization from Departmental Representative.

Part 3 Execution

3.1 INSTALLERS

- .1 Use installers who are Member in Good Standing of Landscape Ontario Horticultural Trades Association.

3.2 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sod installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.3 PREPARATION

- .1 Verify that grades are correct and prepared in accordance with Section 32 91 19.13 - Topsoil Placement and Grading. If discrepancies occur, notify Departmental Representative and commence work when instructed by Departmental Representative.
- .2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.
- .3 Fine grade surface free of humps and hollows to smooth, even grade, to elevations indicated, to tolerance of plus or minus 8 mm, for Turf Grass Nursery Sod surface to drain naturally.

- .4 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site.

3.4 SOD PLACEMENT

- .1 Ensure sod placement is done under supervision of certified Landscape Planting Supervisor.
- .2 Lay sod within 24 hours of being lifted if air temperature exceeds 20 degrees C.
- .3 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
- .4 Roll sod as directed by Departmental Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

3.5 SOD PLACEMENT ON SLOPES AND PEGGING

- .1 Install and secure geotextile fabric in areas indicated, in accordance with manufacturer's instructions.
- .2 Start laying sod at bottom of slopes.
- .3 Peg sod on slopes steeper than 3 horizontal to 1 vertical, within 1 m of catch basins and within 1 m of drainage channels and ditches to following pattern:
 - .1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.
 - .2 Not less than 3-6 pegs per square metre.
 - .3 Not less than 6-9 pegs per square metre in drainage structures. Adjust pattern as directed by Departmental Representative.
 - .4 Drive pegs to 20 mm above soil surface of sod sections.

3.6 FERTILIZING PROGRAM

- .1 Fertilize during establishment and warranty periods as per industry best practices. Provide schedule and rate of application for fertilizing program to Parks Canada for review and approval:

Date	Date	Rate	Ratio
[] to	[]	[kg/ha]	[]
[] to	[]	[kg/ha]	[]
[] to	[]	[kg/ha]	[]

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .1 Clean and reinstate areas affected by Work.
 - .2 Remove recycling and compost containers and bins from site and dispose of materials at appropriate facility.

3.8 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following operations from time of installation until acceptance.
 - .1 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
 - .2 Cut grass to 50 mm when or prior to it reaching height of 75 mm.
 - .3 Maintain sodded areas weed free 95%.
 - .4 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.
 - .5 Temporary barriers or signage to be maintained where required to protect newly established sod.

3.9 ACCEPTANCE

- .1 Turf Grass Nursery Sod areas will be accepted by Departmental Representative provided that:
 - .1 Sodded areas are properly established.
 - .2 Sod is free of bare and dead spots.
 - .3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 50 mm.
 - .4 Sodded areas have been cut minimum 2 times prior to acceptance.
- .2 Sodded Commercial Grade Turf Grass Nursery Sod areas will be accepted by Departmental Representative provided that:
 - .1 Sodded areas are properly established.
 - .2 Extent of surface soil visible when grass has been cut to height of 60 mm is acceptable.
 - .3 Sod is free of bare or dead spots and extent of weeds apparent in grass is acceptable.
 - .4 Sodded areas have been cut minimum 2 times prior to acceptance.
 - .5 Fertilizing in accordance with fertilizer program has been carried out at least once.
- .3 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.
- .4 When environmental conditions allow, all sodded areas showing shrinkage cracks shall be top-dressed and seeded with a seed mix matching the original.

- .5 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

3.10 MAINTENANCE DURING WARRANTY PERIOD

- .1 Perform following operations from time of acceptance until end of warranty period:
 - .1 Water sodded areas at weekly intervals to obtain optimum soil moisture conditions to depth of 100 mm.
 - .2 Repair and resod dead or bare spots to satisfaction of Departmental Representative.
 - .3 Cut grass and remove clippings as directed by Departmental Representative to height as follows:
 - .1 Turf Grass Nursery Sod:
 - .1 50 mm during normal growing conditions.
 - .2 Cut grass at 2 week intervals but at intervals so that approximately one third of growth is removed in single cut.
 - .3 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.
 - .4 Eliminate weeds by mechanical means to extent acceptable to Departmental Representative.

END OF SECTION

Approved: 2011-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 91 19-13 Topsoil Placement and Grading.

1.2 REFERENCES

- .1 Definitions:
 - .1 Mycorrhiza: association between fungus and roots of plants. This symbiosis, enhances plant establishment in newly landscaped and imported soils.
- .2 Reference Standards:
 - .1 Agriculture and Agri-Food Canada (AAFC).
 - .1 Plant Hardiness Zones in Canada-2000.
 - .2 Canadian Nursery Landscape Association (CNLA)
 - .1 Canadian Standards for Nursery Stock-2006.
 - .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Scheduling: obtain approval from Departmental Representative of schedule 7 days in advance of shipment of plant material.
- .2 Schedule to include:
 - .1 Quantity and type of plant material.
 - .2 Shipping dates.
 - .3 Arrival dates on site.
 - .4 Planting Dates.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Samples:
 - .1 Submit samples of mulch.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Landscape Contractor: to be a Member in Good Standing of Landscape Ontario Horticultural Trades Association.
 - .2 Landscape Planting Supervisor: Landscape Industry Certified Technician with Softscape Installation designation.

- .3 Landscape Maintenance Supervisor: Landscape Industry Certified Technician with Ornamental Maintenance designation.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .1 Protect plant material from frost, excessive heat, wind and sun during delivery.
 - .2 Protect plant material from damage during transportation:
 - .1 Delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.
 - .2 Delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical.
 - .3 Protect foliage and root balls using anti-desiccants and tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.
- .3 Storage and Handling Requirements:
 - .1 Immediately store and protect plant material which will not be installed within 2 hours in accordance with supplier's written recommendations and after arrival at site in storage location approved by Departmental Representative.
 - .2 Protect stored plant material from frost, wind and sun and as follows:
 - .1 For bare root plant material, preserve moisture around roots by heeling-in or burying roots in sand or topsoil and watering to full depth of root zone.
 - .2 For pots and containers, maintain moisture level in containers. Heel-in fibre pots.
 - .3 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.
 - .3 Store and manage hazardous materials in accordance with manufacturer's written instructions.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 WARRANTY

- .1 End-of-warranty inspection will be conducted by Departmental Representative.
- .2 Departmental Representative reserves the right to extend Contractor's warranty responsibilities for an additional one year if, at end of initial warranty period, leaf development and growth is not sufficient to ensure future survival.

Part 2

Products

2.1 PLANT MATERIAL

- .1 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock.
 - .1 Source of plant material: grown in Zone 6 or less in accordance with Plant Hardiness Zones in Canada.
 - .2 Plant material must be planted in zone specified as appropriate for its species.
 - .3 Plant material in location appropriate for its species.
- .2 Final approval of plant material and sourcing will be provided by Resource Conservation staff. The plant material must be procured from a qualified and approved producer.
- .3 Plant material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system.
- .4 Trees: with straight trunks, well and characteristically branched for species.
- .5 Trees larger than 200 mm in caliper: half root pruned during each of two successive growing seasons, the latter at least one growing season before arrival on site.
- .6 Bare root stock: nursery grown, in dormant stage, not balled and burlapped or container grown.
- .7 Collected stock: maximum 40 mm in caliper, with well developed crowns and characteristically branched; no more than 40% of overall height may be free of branches.
 - .1 During collection, ensure 10% maximum seed crop (or plants) are collected from healthy population of many individuals, and from several plants of same species.
 - .2 Leave remainder for natural dispersal and as food for dependent organisms.

2.2 WATER

- .1 Free of impurities that would inhibit plant growth.

2.3 STAKES

- .1 T-bar, steel, 40 x 40 x 5 x 2440 mm.

2.4 WIRE TIGHTENER

- .1 Type 1: galvanized steel.
- .2 Type 2: turnbuckle, galvanized steel, 9.5 mm diameter with 270 mm open length.

2.5 GUYING WIRE

- .1 Type 1: steel, 3 mm wire.
- .2 Type 2: 1.5 mm diameter multi-wire steel cable.
- .3 Type 3: 3 mm diameter multi-wire steel cable.

2.6 CLAMPS

- .1 U-bolt: galvanized, 13 mm diameter, c/w curved retaining bar and hex nuts.

- .2 Crimp type.
- 2.7 ANCHORS**
 - .1 Wood:
 - .1 Type 1: 38 x 38 x 460 mm.
 - .2 Type 2: 38 x 67 x 600 mm.
 - .2 Drive-in type.
 - .1 Type 1: 13 mm diameter x 75 mm long.
 - .2 Type 2: 18 mm diameter x 120 mm long].
 - .3 Screw-in type:
 - .1 Type 1: 100 mm diameter steel disc.
- 2.8 GUYING COLLAR**
 - .1 Tube: plastic, 13 mm diameter, nylon reinforced.
- 2.9 TRUNK PROTECTION**
 - .1 Wire mesh: galvanized, electrically welded 1.4 mm wire with 25 x 25 mm mesh and fastener.
 - .2 Plastic: perforated spiralled strip.
 - .3 Burlap: clean 2.5 kg/m² minimum mass and 150 mm minimum wide, and twine fastener.
 - .4 Tar impregnated crepe paper and twine fastener.
- 2.10 MULCH**
 - .1 Shredded wood: varying in size from 25 to 125 mm in length, from cedar or pine trees.
- 2.11 FERTILIZER**
 - .1 Synthetic commercial type as recommended by soil test report manufacturer.
 - .1 Ensure new root growth is in contact with mycorrhiza.
 - .2 Use mycorrhiza as recommended by manufacturer's written recommendations.
- 2.12 ANTI-DESICCANT**
 - .1 Wax-like emulsion.
- 2.13 SOURCE QUALITY CONTROL**
 - .1 Obtain approval from Departmental Representative of plant material prior to planting.
 - .2 Imported plant material must be accompanied with necessary permits and import licenses. Conform to Federal, Provincial or Territorial regulations.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for planting installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PRE-PLANTING PREPARATION

- .1 Proceed only after receipt of written acceptability of plant material from Departmental Representative.
- .2 Remove damaged roots and branches from plant material.
- .3 Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.
- .4 Locate and protect utility lines.
- .5 Notify and acquire written acknowledgment from utility authorities before beginning excavation of planting pits for trees and shrubs.
- .6 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 EXCAVATION AND PREPARATION OF PLANTING BEDS

- .1 Preparation of planting beds in accordance with Section 32 91 19.13 - Topsoil Placement and Grading.
- .2 For individual planting holes:
 - .1 Stake out location and obtain approval from Departmental Representative prior to excavating.
 - .2 Excavate to depth and width as indicated.
 - .3 Remove subsoil, rocks, roots, debris and toxic material from excavated material that will be used as planting soil for trees and individual shrubs. Dispose of excess material.
 - .4 Scarify sides of planting hole.

- .5 Remove water which enters excavations prior to planting. Notify Departmental Representative if water source is ground water.

3.4 PLANTING

- .1 For bare root stock, place 50 mm backfill soil in bottom of hole.
 - .1 Plant trees and shrubs with roots placed straight out in hole.
- .2 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball.
 - .1 Do not pull burlap or rope from under root ball.
- .3 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.
- .4 Plant vertically in locations as indicated.
 - .1 Orient plant material to give best appearance in relation to structure, roads and walks.
- .5 For trees and shrubs:
 - .1 Backfill soil in 150 mm lifts.
 - .1 Tamp each lift to eliminate air pockets.
 - .2 When two thirds of depth of planting pit has been backfilled, fill remaining space with water.
 - .3 After water has penetrated into soil, backfill to finish grade.
 - .2 Form watering saucer as indicated.
- .6 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.
- .7 Water plant material thoroughly.
- .8 After soil settlement has occurred, fill with soil to finish grade.

3.5 TRUNK PROTECTION

- .1 Install trunk protection on deciduous trees as indicated.
- .2 Install trunk protection before installation of tree supports.

3.6 TREE SUPPORTS

- .1 Install tree supports as indicated.
- .2 Use single stake tree support for deciduous trees less than 3 m in height and evergreens less than 2 m in height.
 - .1 Place stake on prevailing wind side and 150 mm minimum from trunk.
 - .2 Drive stake 150 mm minimum into undisturbed soil beneath roots.
 - .1 Ensure stake is secure and vertical.
 - .3 Install 150 mm long guying collar 1500 mm above grade.
 - .4 Thread Type 1 guying wire through guying collar tube.
 - .1 Twist wire to form collar and secure firmly to stake. Cut off excess wire.

- .3 Use 3 guy wires and anchors for deciduous trees greater than 3 m in height and evergreens greater than 2 m in height.
 - .1 Use Type 2 guying wire with clamps for trees less than 75 mm in diameter and Type 3 guying wire with clamps for trees greater than 75 mm in diameter.
 - .2 Use Type 1 anchors for trees less than 75 mm in diameter and Type 2 anchors for trees greater than 75 mm in diameter.
 - .3 Install guying collars above branch to prevent slipping at approximately 2/3 height for evergreens and 1/2 height for deciduous trees. Collar mounting height not to exceed 2.5 m above grade.
 - .4 Guying collars to be of sufficient length to encircle tree plus 50 mm space for trunk clearance. Thread guy wire through collar encircling tree trunk and secure to lead wire by clamp or multi-wraps; cut wire ends close to wrap. Spread lead wires equally proportioned about trunk at 120 degrees.
 - .5 Install anchors at equal intervals about tree and away from trunk so guy wire will form 30 degree angle with ground. Install anchor at angle to achieve maximum resistance for guy wire.
 - .6 Attach guy wire to anchors. Tension wire and secure by installing clamps.
 - .7 Install wire tightener ensuring that guys are secure and leave room for slight movement of tree.
- .4 After tree supports have been installed, remove broken branches with clean, sharp tools.

3.7 MULCHING

- .1 Ensure soil settlement has been corrected prior to mulching.
- .2 Spread mulch as indicated.

3.8 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following maintenance operations from time of planting to acceptance by Departmental Representative.
 - .1 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.
 - .1 For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.
 - .2 Remove weeds monthly.
 - .3 Replace or re-spread damaged, missing or disturbed mulch.
 - .4 For non-mulched areas, cultivate as required to keep top layer of soil friable.
 - .5 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative prior to application.
 - .6 Remove dead or broken branches from plant material.
 - .7 Keep trunk protection and guy wires in proper repair and adjustment.

- .8 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

3.9 MAINTENANCE DURING WARRANTY PERIOD

- .1 From time of acceptance by Departmental Representative to end of warranty period, perform following maintenance operations.
 - .1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.
 - .2 Reform damaged watering saucers.
 - .3 Remove weeds monthly.
 - .4 Replace or re-spread damaged, missing or disturbed mulch.
 - .5 For non-mulched areas, cultivate monthly to keep top layer of soil friable.
 - .6 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative prior to application.
 - .7 Apply fertilizer in early spring as indicated by soil test.
 - .8 Remove dead, broken or hazardous branches from plant material.
 - .9 Keep trunk protection and tree supports in proper repair and adjustment.
 - .10 Remove trunk protection, tree supports and level watering saucers at end of warranty period.
 - .11 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.
 - .12 Submit monthly written reports to Departmental Representative identifying:
 - .1 Maintenance work carried out.
 - .2 Development and condition of plant material.
 - .3 Preventative or corrective measures required which are outside Contractor's responsibility.

3.10 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Divert discarded burlap, wire and plastic plant containers materials from landfill to plastic recycling facility approved by Departmental Representative.
 - .3 Dispose of unused fertilizer at official hazardous material collection site approved by Departmental Representative.

- .4 Dispose of unused anti-desiccant at official hazardous material collections site approved by Departmental Representative.
- .5 Divert unused wood and mulch materials from landfill to composting facility approved by Departmental Representative.

3.11 CLOSEOUT ACTIVITIES

- .1 Submit maintenance reports for trees, shrubs, and other plantings.

END OF SECTION

Approved: 2006-06-30

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 32 01 90-33 Tree and Shrub Preservation.

1.2 MEASUREMENT PROCEDURES

- .1 Measure tree pruning for payment per tree.

1.3 REFERENCES

- .1 American National Standard Institute (ANSI)
 - .1 ANSI A300 (Part 1)-2001, Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance - Standard Practices (revision and re-designation of ANSI A300-1995) (includes supplements).
 - .2 ANSI A300 (Part 2)-1998, Tree Care Operations - Tree, Shrub, and Other Woody Plant Maintenance - Standard Practices - Part 2 - Fertilization.
 - .3 ANSI A300 (Part 3)-2000, Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance: Standard Practices - Part 3 - Tree Support Systems (a. Cabling, Bracing, and Guying) (supplement to ANSI A300-1995).
- .2 Canadian Nursery Landscape Association (CNLA)
- .3 International Society of Arboriculture (ISA)
- .4 Ontario Ministry of Agriculture, Food and Rural Affairs
 - .1 Publication 483-2004, Pruning Ornamentals.

1.4 DEFINITIONS

- .1 Crown Cleaning: consists of selective removal of one or more of following items: dead, dying or diseased branches, weak branches and water sprouts.
- .2 Crown Thinning: consists of selective removal of branches to increase light penetration, air movement and reduce weight.
- .3 Crown Raising: consists of removal of lower tree branches to provide clearance.
- .4 Crown Reduction or Crown Shaping: decreases tree height and/or spread.
- .5 Vista Pruning: is selective thinning of framework limbs or specific crown areas to improve views.
- .6 Crown Restoration: improves structure, form and appearance of trees that have been severely headed or vandalized.

1.5 QUALITY ASSURANCE

- .1 Certification: provide Canadian Nursery Landscape Association certification.

- .2 Field Samples: do sample pruning in manner to enable Departmental Representative to identify:
 - .1 Knowledge of target areas including branch bark ridge and branch collars.
 - .2 Technique for selection process and pruning used to establish desired form and shape for each species.
- .3 Acceptance of Work will be determined by Departmental Representative from field sample.
- .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Dispose of unused disinfectant at official hazardous material collections site approved by Departmental Representative.
- .4 Ensure emptied containers are sealed and stored safely.
- .5 Divert wood materials from landfill to facility for composting as directed by Departmental Representative.

1.7 TOOL MAINTENANCE

- .1 Ensure that tools are clean and sharp throughout pruning operation: do not use tools that crush or tear bark.
- .2 Disinfect tools before each tree is pruned.
- .3 On diseased plant material disinfect tools before each cut.

Part 2 Products

2.1 DISINFECTANT

- .1 20% solution of sodium hypochlorite or 70% solution of ethyl alcohol.

Part 3 Execution

3.1 APPLICATION

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

3.2 GENERAL

- .1 Prune in accordance with Pruning Ornamentals, and as directed by Departmental Representative. Where discrepancies occur between standard and specifications, specifications govern.
- .2 Notify immediately Departmental Representative conditions detrimental to health of plant material or operations.
- .3 Prune during plant dormant period or after leaves have matured. Avoid pruning during leaf formation, at time of leaf fall, or when seasonal temperature drops below minus 10 degrees C.
- .4 Prune each species when in full leaf.
- .5 Retain natural form and shape of plant species.
- .6 Do not:
 - .1 Flush cut branches.
 - .2 Crush or tear bark.
 - .3 Cut behind branch bark ridge.
 - .4 Damage branch collars.
 - .5 Damage branches to remain.

3.3 PRUNING

- .1 Remove dead, dying, diseased and weak growth from plant material to provide crown raising in order to promote healthy growth.
- .2 Remove live branches that:
 - .1 Interfere with healthy development and structural strength including branches crossed or rubbing more important branches.
 - .2 Are of weak structure including narrow crotches.
 - .3 Obstruct development of more important branches.
 - .4 Are broken.
- .3 Remove live branches to re-establish natural species form including:
 - .1 One or more developing leaders.
 - .2 Multiple growth due to previous topping.
 - .3 Branches extending outward from natural form.
 - .4 Undesirable sucker growth.
- .4 Remove loose branches, twigs and other debris lodged in tree.
- .5 Remove vines.
- .6 For branches under 50 mm in diameter:
 - .1 Locate branch bark ridge and make cuts smooth and flush with outer edge of branch collar to ensure retention of branch collar. Cut target area to bottom of branch collar at angle equal to that formed by line opposite to branch bark ridge.

- .2 Make cuts on dead branches smooth and flush with swollen callus collar. Do not injure or remove callus collar.
- .3 Do not cut lead branches unless directed by Departmental Representative.
- .7 For branches greater than 50 mm in diameter:
 - .1 Make first cut on lower side of branch 300 mm from trunk, one third diameter of branch.
 - .2 Make second cut on upper side of branch 500 mm from trunk until branch falls off.
 - .3 Make final cut adjacent to and outside branch collar.
- .8 Ensure that trunk bark and branch collar are not damaged or torn during limb removal.
 - .1 Repair areas which are damaged, or remove damaged area back to next branch collar.
- .9 Remove additional growth designated by Departmental Representative.

3.4 ROOT GIRDLING

- .1 For girdling roots one-quarter size of trunk diameter or larger, V-cut girdling root one-half way through at point where root is crossing.
- .2 Remove exposed portion of girdling root as directed by Departmental Representative after cleanly cutting root flush with grade on each side of parent root. Do not injure bark or parent root.

3.5 CARE OF WOUNDS

- .1 Shape bark around wound to oblong configuration ensuring minimal increase in wound size. Retain peninsulas of existing live bark.

3.6 CLEAN-UP

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Collect and dispose of pruned material and remove from site.
- .3 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION