1.01 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 regulations.

1.02 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 Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean at all times throughout the Work.

.5 Closures: protect work temporarily until permanent enclosures are completed.

.6 Green Gables Heritage Place is of national significance. Damage to the site and facilities is not permitted, and all damage shall be repaired and restored to original condition at the direction and sole approval of the Departmental Representative. Reparations, if required, shall be at the sole expense of the Contractor. Work of Contract is permitted.

1.03 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 72 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions outside of Hours of Operation and after normal working hours of staff, or as approved by Departmental Representative.

.3 Provide for personnel, pedestrian and vehicular traffic.

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

1.04 SPECIAL REQUIREMENTS

.1 Green Gables Heritage Place Hours of Operation (Open to the Public):
- .1 April 15th to 30th: open by special appointment only; consult with Departmental Reprehensive to determine appointment dates and hours scheduled.
- .2 May 1st to October 31st: open daily 9am to 5pm.
- .3 November 1st to 30th: open by special appointment only; consult with Departmental Reprehensive to determine appointment dates and hours scheduled.
- .4 December 1st to April 14th: closed for the season.

.2 During Hours of Operation (Open to the Public): Paint and carpet occupied areas from 6pm to 8am only unless otherwise approved by Departmental Representative. During seasonal closure and non-operating times, Work times at Contractor’s discretion in conformance with Employment Standards Act and Regulations of PEI.

.3 During Hours of Operation (Open to the Public): Carry out noise generating Work from 6pm to 8am only unless otherwise approved by Departmental Representative. During seasonal closure and non-operating times, Work times at Contractor’s discretion in conformance with Employment Standards Act and Regulations of PEI.

.4 Submit schedule in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart.

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

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

.7 Ingress and egress of Contractor vehicles at site is limited to existing roadways.

.8 During Hours of Operation (Open to the Public): Deliver materials from 6pm to 8am only unless otherwise approved by Departmental Representative. During seasonal closure and non-operating times, Work times at Contractor's discretion in conformance with Employment Standards Act and Regulations of PEI.

.9 Arrange for site visit with Departmental Representative during the tender period and prior to tender submission to examine existing site conditions as necessary.

1.05 SECURITY

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

1.06 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. Smoking and "vaping" (use of electronic cigarettes, vaporizers and e-liquids) are not permitted.

END OF SECTION

1.01 APPOINTMENT AND PAYMENT

.1 Departmental Representative will appoint and pay for services of testing laboratory, except follows:
  .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 supervision of Departmental Representative.

.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 to verify acceptability of corrected work.

1.02 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 72 hours minimum 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.

END OF SECTION

1.01 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.

.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, and Departmental Representative whether in attendance or absent.

.8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.02 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 Senior representatives of Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum 7 days before meeting.

.4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.

.5 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 Delivery schedule of specified equipment in accordance with Section 01 14 00.
.6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
.7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
.8 Owner provided products.
.9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
.10 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
.11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
.12 Monthly progress claims, administrative procedures, photographs, hold backs.
.13 Appointment of inspection and testing agencies or firms.
.14 Insurances, transcript of policies.

1.03 PROGRESS MEETINGS

.1 During course of Work and 2 weeks prior to project completion, schedule progress meetings monthly.

.2 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance.

.3 Notify parties minimum three days prior to meetings.

.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within three 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.

END OF SECTION

1.01 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): 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, work package, 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 activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. 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 Departmental Representative to enable monitoring of project work in relation to established milestones.

1.02 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.

1.03 ACTION AND INFORMATION SUBMITTALS

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

.2 Submit to Departmental Representative within 15 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

.3 Submit Project Schedule to Departmental Representative within 7 working days of receipt of acceptance of Master Plan.

1.04 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Departmental Representative will review and return revised schedules within 7 working days.

.3 Revise impractical schedule and resubmit within 7 working days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.05 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 Structure Demolition and related site works.
.6 Selective Demolition at Barn.
.7 Excavation.
.8 Backfill.
.9 Building footings.
.10 Slab on grade.
.11 Structural framing and panels.
.12 Siding and Roofing.
.13 Interior Architecture (Walls, Floors and Ceiling).
.14 Plumbing.
.15 Lighting.
.16 Electrical.
.17 Piping.
.18 Controls.
.19 Heating, Ventilating, and Air Conditioning.
.20 Millwork.
.21 Fire Systems.
.22 Testing and Commissioning.
.23 Supplied equipment long delivery items.

1.06 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.

1.07 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.

END OF SECTION

1.01 ADMINISTRATIVE

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

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

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

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

.5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and 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, 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 review of submittals.

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

.10 Keep one reviewed copy of each submission on site.

1.02 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Prince Edward Island, 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 7 working days for Departmental Representative's review of each submission.

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

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

.7 Accompany submissions with transmittal letter, in triplicate, containing:
- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.8 Submissions include:
- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.

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

.10 Submit electronic copy in PDF format (one password protected and one editable version) of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.11 Submit electronic copy in PDF format (one password protected and one editable version) of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit electronic copy in PDF format (one password protected and one editable version) of test reports for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
.2 Testing must have been within 3 years of date of contract award for project.

.13 Submit electronic in PDF format (one password protected and one editable version) of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit electronic in PDF format (one password protected and one editable version) of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.
.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit electronic in PDF format (one password protected and one editable version) of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

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

.17 Submit electronic in PDF format (one password protected and one editable version) of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.18 Delete information not applicable to project.

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

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

.21 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.

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

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

1.03 SAMPLES

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

.2 Deliver samples prepaid to Departmental Representative's business address, or site office as directed by Departmental Representative.

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

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

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

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

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

1.04 MOCK-UPS

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

1.05 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic copy of colour digital photography in Tagged Image File Format 6.0 (TIFF 6.0), fine resolution with progress statement and as directed by Departmental Representative.

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

.3 Number of viewpoints: 4 locations.
.1 Viewpoints and their location as determined by Departmental Representative.

.4 Frequency of photographic documentation: weekly or as otherwise directed by Departmental Representative.
.1 Upon completion of: demolition and selective demolition, excavation, foundation, framing and services before concealment, of Work, and as directed by Departmental Representative.

END OF SECTION

1.01 GENERAL PROTECTION

.1 Work shall comply with or exceed the requirements of the following:
  .1 Canada National Parks Act (S.C. 2000, c. 32), including amendments up to tender closing date.
  .2 National Parks Building Regulations (C.R.C., c. 1114).

1.02 PRESERVATION OF PROPERTY

.1 At direction of Departmental Representative, a start up meeting will be held on site involving the Contractor and primary sub-contractors. The meeting shall be to ensure primary construction personnel are aware of the environmental concerns, laws, rules and regulations pertaining to Green Gables Heritage Place.

.2 All site regulations, relevant federal and provincial acts, regulations, guidelines and codes of good practice apply to all Work and activities associated with this project.

.3 The Work shall be performed in a manner that will not have a significant environmental impact on Green Gables Heritage Place property and its natural resources, including but not limited to flora, fauna or natural objects, or pose a danger to health and safety.

.4 Equipment and machinery shall be minimally invasive in size, vibration potential, and weight. When practicable for the task, use light duty construction equipment, such as mini-excavator, skid steers, portable hand-held equipment, single axle truck cranes (≤ 19,000 GVW), and similar light weight equipment options, or as approved by Departmental Representative.

.5 Do not use equipment or vehicles that impose loads in excess of the load capacity of site roads and parking areas. If load capacity of existing roads and parking lots is not available or is otherwise uncertain, assume that they have been designed as low-volume roads and parking lots and not for heavy use and heavy loads.

.6 Areas adjacent to designated work areas may be sensitive ecosystems or historically significant that can be easily damaged and harmed; in order to limit risk of damaging adjacent Park property and sensitive ecosystems or historically designated elements, restrict work, workers and equipment, including staging and storage areas, to designated work areas.

.1 Do not permit equipment to stray from work locations, and only extend work to adjacent areas as minimally necessary to complete the Work, and only as authorized by Departmental Representative; submit workplans and work layout drawings to Departmental Representative for review and approval.

1.03 HOT WORK

.1 During and for 1-hour after any activity with potential to produce ignition sources or excess heat, ensure the attendance of trained fire-watch personnel to monitor, investigate and respond to conditions.

.2 Submit hot works policy and procedure manual to Departmental Representative prior to commencing Work at site.

.3 Take precautions to prevent fires. Provide and maintain temporary fire protection equipment of a type appropriate to the hazard anticipated in accordance with authorities having jurisdiction, governing Codes, Regulations, and Ordinances. Every worker who may be required to use fire extinguishing equipment shall be trained in its proper use.

END OF SECTION

1.01 REFERENCES

.1 American Society of Heating Refrigeration and Air-Conditioning (ASHRAE)
- .1 ANSI/ASHRAE 52.2-2017, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- .2 ANSI/ASHRAE 55-2013, Thermal Environmental conditions for Human Occupancy.
- .3 ANSI/ASHRAE 62.1-2016, Ventilation for Acceptable Indoor Air Quality.
- .4 ANSI/ASHRAE 90.1-2016, Energy Standard for Buildings Except Low-rise Residential Lighting.

.2 Canada Green Building Council (CaGBC)
- .1 LEED® Canada 2009 Rating System, LEED® Canada for New Construction and Major Renovations.

.3 Carpet and Rug Institute (CRI)
- .1 CRI Green Label and Green Label Plus Indoor Air Quality Test Program - Green Label and Green Label Plus Testing Program.

.4 Forest Stewardship Council
- .1 FSC-STD-01-001(Version 4-0), FSC Principles and Criteria for Forest Stewardship.

.5 Green Seal Environmental Standards
- .1 Standard GS-11, Paints, Coatings, Stains, and Sealers, Edition 3.2, October 26, 2015.
- .2 Standard GS-36, Adhesives for Commercial Use, Edition 2.1, July 12, 2013.

.6 Scientific Certification System (SCS)/Resilient Floor Covering Institute (RFCI)
- .1 FloorScore Standard.

.7 South Coast Air Quality Management District (SCAQMD), California State
- .1 SCAQMD Rule 1113-A2016, Architectural Coatings.
- .2 SCAQMD Rule 1168-A2011, Adhesives and Sealants Applications.

.8 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- .1 ANSI/SMACNA 008-2008, IAQ Guideline for Occupied Buildings Under Construction, 2nd Edition.

1.02 DEFINITIONS

.1 FSC - Forest Stewardship Council.

.2 SFM - Sustainable Forest Management.

.3 CFC - Chlorofluorocarbons.

.4 Chain-of-Custody Certification - certificates signed by manufacturers certifying that wood used to make products was obtained from FSC certified forests. Certificates include evidence that mill is certified for chain-of-custody by FSC-accredited certification body.

.5 HCFC - Hydro Chlorofluorocarbons.

.6 LEED® - Leadership in Energy and Environmental Design.

.7 IAQ - Indoor Air Quality.

.8 Rapidly Renewable Materials - materials made from agricultural products that are typically harvested within a ten-year or shorter cycle. Rapidly renewable materials include but are not limited to products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, and wool.

.9 Regionally Extracted Materials – raw materials taken from within an 800 km (2,400 km if shipped by rail or water) radius of the manufacturing location.

.10 Regionally Manufactured Materials - materials that are manufactured within a radius of 800 km (2,400 km if shipped by rail or water) from project location. Manufacturing refers to the final assembly of components into the building product that is installed at project site.

.11 Recycled Content - percentage by weight of constituents that have been recovered or otherwise diverted from solid waste stream, either pre-consumer or post-consumer.

.1 Wastes and scraps from manufacturing process that are combined with other materials after minimal amount of reprocessing for use in further production of same product are not recycled materials.

.2 Discarded materials from one manufacturing process that are used as materials in another manufacturing process are pre-consumer recycled materials.

1.03 ACTION AND INFORMATION SUBMITTALS

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

.2 Submit additional LEED® submittal requirements included in other sections in accordance with Section 01 33 00 - Submittal Procedures.

.1 When submitted items are duplicated to that submitted to comply with other requirements, submit duplicate copies as separate submittals for compliance with indicated LEED® requirements.

.2 Complete and submit LEED® Information Submittal Forms for each Product subject to Contract LEED® requirements.

.1 Refer to Section 01 35 22 for blank submittal forms.

.2 Refer to LEED® Scorecard attached following this Section. Items under the 'Yes' column are mandatory and compliance is required.

.3 Submit breakdown of labour and material costs for building materials used for Project excluding mechanical and electrical components.

.4 Submit: LEED® Action Plan: provide preliminary submittals within 14 days of date for start of Work indicating how the following requirements will be met.

.1 Erosion and Sedimentation Control Plan

.2 Materials and Resources Credit MR-2 Construction Waste Management

.3 Materials and Resources Credit MR-4 Recycled Content (post-consumer recycled content + 1/2 pre-consumer recycled content). Submit list of proposed materials with recycled content.

.1 Identify cost, post-consumer content and pre-consumer content for products having recycled content.

.4 Environment Quality Credit IEQ-3.1 Construction IAQ Management Plan. Submit Construction indoor air quality management plan prepared in accordance with ANSI/SMACNA-008.

.5 Submit LEED® Progress Reports: with Applications for Progress Payments, submit reports comparing actual construction and purchasing activities with LEED® action plans for the following:

.1 Materials and Resources Credit MR-2 Construction Waste Management. Submit Waste reduction progress reports in accordance with 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Materials and Resources Credit MR-4 Recycled Content (post-consumer + 1/2 pre-consumer). Submit list of recycled content of materials.

.6 LEED® Documentation Submittals:

.1 ESC Inspection Reports (monthly)

.2 IAQ Inspection Reports (weekly)

.3 Submit product data for lighting fixtures for Sustainable Sites Credit SS-8 Light Pollution Reduction. Submit data for interior and exterior lighting fixtures that stop direct-beam illumination from leaving the building site.

.4 Submit product data for plumbing fixture and water meters for Water Efficiency Prerequisites and Credits including WE-1 Water Use Reduction, 20% Reduction, WE-2 Innovative Wastewater Technologies, WE-3 Water Use Reduction. Submit Data for plumbing fixtures indicating water consumption.

.5 Submit product data for Energy and Atmosphere Credit EA-4 Enhanced Refrigerant Management. Submit product data for new HVAC equipment indicating quantity of HCFC refrigerants and for clean-agent fire-extinguishing systems indicating absence of (H)CFC and Halon.

.6 Submit Construction Waste Management Plan for Materials and Resources Credit MR-2 Construction Waste Management. Comply with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.7 Submit product data and shop drawing for Indoor Environmental Quality Credit EQ-1 Outdoor Air Delivery Monitoring. Submit product data and shop drawings for carbon dioxide monitoring system.

.8 Provide submittals for Indoor Environmental Quality Credit EQ-3.1 Construction IAQ Management Plan During Construction. Include the following:

.1 Construction indoor air quality management plan.

.2 Product data for temporary filtration media.

.3 Product data for filtration media used during occupancy.
.4 Construction documentation: submit 18 photographs documenting IAQ performance during construction with date and time stamp. Include representative photos of methods. Two (2) different time periods must be included. Provide description of utilized IAQ measures in accordance with SMACNA, documenting protection of ducts and on-site stored or installed absorptive materials from moisture.

.9 Provide submittals for Indoor Environmental Quality Credit EQ-3.2 Construction IAQ Management Plan: Before Occupancy. Include the following:
.1 Signed statement describing building air flush-out procedures including start and completion dates of flush out and statement that filtration media was replaced after flush-out or
.2 Product data for filtration media used during flush-out and during occupancy or
.3 Report from testing and inspecting agency indicating results of IAQ testing and documentation showing conformance with IAQ testing procedures and requirements.

.10 Submit product data for Indoor Environmental Quality Credit EQ-4.1 Low-Emitting Materials: Adhesives and Sealants. Submit product data, MSDS, and completed Green Building Submittal Form for interior adhesives and sealants indicating VOC content of product used. Indicate VOC content in g/L calculated in accordance with SCAQMD Rule 1168 and Green Seal Standard GS-36.

.11 Submit product data for Indoor Environmental Quality Credit EQ-4.2 Low-Emitting Materials: Paints and Coatings. Submit product data, MSDS, and completed Green Building Submittal Form for interior paints and coatings indicating chemical composition and VOC content for products used. Indicate VOC content in g/L calculated in accordance with Green Seal Standard GS-11, Green Seal Standard GS-36, and SCAQMD Rule 1113.

.12 Submit product data for indoor Environmental Quality Credit EQ-4.3 Low-Emitting Materials: Flooring Systems. Submit product data, MSDS, and completed Green Building Submittal Form for flooring products indicating VOC content in accordance with CRI Green Label and Green Label Plus Program for carpet, FloorScore standard for hard surface flooring systems and SCAQMD Rule 1113 for concrete, wood, bamboo and cork floor finishes such as sealers, stains and finishes.

.13 Submit product data for Indoor Environmental Quality Credit EQ-4.4 Low-Emitting Materials: Composite Wood and Agrifibre Products. Submit product data for composite wood and agrifibre products indicating products contain no urea-formaldehyde resins.

.1 Include statement for adhesives use in fabrication of laminated assemblies.

.14 Submit product data and shop drawing for Indoor Environmental Quality Credit EQ-6.1 Controllability of Systems: Lighting and EQ-6.2 Controllability of Systems: Thermal Comfort. Submit product data and shop drawings for sensors and control systems used for individual airflow, temperature and lighting for minimum 50% of non-perimeter, regularly occupied space.

.15 Submit product data and shop drawings for Indoor Environmental Quality Credit EQ-7.2 Thermal Comfort: Monitoring. Submit product data and shop drawings for permanent monitoring sensors and controls system for temperature and humidity.

1.04 RECYCLED CONTENT OF MATERIALS

.1 Materials and Resources Credits MR-4 Recycled Content: 10% (post-consumer + 1/2 pre-consumer) and Recycled Content: 20% (post-consumer + 1/2 pre-consumer). Supply building materials with recycled contents such that the sum of post-consumer recycled content plus 1/2 of the pre-consumer content constitutes a minimum of 20% based on cost of project materials.

.1 Cost of post-consumer recycled content of material will be determined by dividing weight of post-consumer recycled content in material by total weight of materials and multiplying by cost of material.

.2 Cost of post consumer recycled content plus one-half of pre-consumer recycled content of materials will be determined by dividing weight of post-consumer recycled content plus one-half of pre-consumer recycled content in material by total weight of material and multiplying by cost of material.
.3 Do not include mechanical and electrical components in calculations.
.4 Recycled content of materials in accordance with Federal Trade Commission's Guide for the Use of Environmental Marketing Claims, 16 CFR 260.7.

1.05 REGIONAL MATERIALS

.1 Materials and Resources Credit MR-5 Regional Materials: 20% and 30% extracted and manufactured regionally. Supply at least 20% of building materials (by cost) that are regionally manufactured and extracted/harvested/recovered.

1.06 CERTIFIED WOOD

.1 Materials and Resources Credit MR-7 Certified Wood. Supply a minimum of 50% (by cost) of wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC Principles and Criteria.

.2 Wood-based materials include but not limited to the following materials when made from made wood, engineered wood products, or wood-based panel products:
.1 Rough carpentry.
.2 Miscellaneous carpentry.
.3 Heavy timber construction.
.4 Wood decking.
.5 Metal-plate-connected wood trusses.
.6 Structural glued-laminated timber.
.7 Finish carpentry.
.8 Architectural woodwork.
.9 Wood panelling.
.10 Wood veneer wall covering.
.11 Wood flooring.
.12 Wood lockers.
.13 Wood cabinets.
.14 Non-rented temporary construction, including bracing, concrete formwork, pedestrian barriers, and temporary protection.

1.07 LOW-EMITTING MATERIALS

.1 Indoor Environmental Quality Credit EQ-4.1 Low-Emitting Materials: Adhesives and Sealants. Interior applications requiring adhesives, sealants and sealant primers must comply with the following content limits for VOC of the State of California's South Coast Air Quality Management District (SCAQMD) Rule 1168 and Green Seal Standard GS-36.

.1 Architectural Applications:

.1 Indoor Carpet Adhesive: 50 g/L.
.2 Carpet Pad Adhesive: 50 g/L.
.3 Wood Flooring Adhesive: 100 g/L.
.4 Rubber Floor Adhesives: 60 g/L.
.5 Subfloor Adhesives: 50 g/L.
.6 Ceramic Tile Adhesives: 65 g/L.
.7 VCT & Asphalt Adhesives: 50 g/L.
.8 Drywall & Panel Adhesives: 50 g/L.
.9 Cove Base Adhesives: 50 g/L.
.10 Multipurpose Construction Adhesives: 70 g/L.
.11 Structural Glazing Adhesives: 100 g/L.

.2 Specialty Applications

.1 PVC Welding: 510 g/L.
.2 CPVC Welding: 490 g/L.
.3 ABS Welding: 325 g/L.
.4 Plastic Cement Welding: 250 g/L.
.5 Adhesive Primer for Plastic: 550 g/L.
.6 Contact Adhesive: 80 g/L.
.7 Special Purpose Contact Adhesive: 250 g/L.
.8 Structural Wood Member Adhesive: 140 g/L.
.9 Sheet Applied Rubber Lining Operations: 850 g/L.
.10 Top & Trim Adhesives: 250 g/L.

.3 Substrate Specific Applications:

.1 Metal to Metal: 30 g/L.
.2 Plastic Foams: 50 g/L.
.3 Porous Material (except wood): 50 g/L.
.4 Wood: 30 g/L.
.5 Fibreglass: 80 g/L.

.4 Sealants:

.1 Architectural: 250 g/L.
.2 Nonmembrane Roof: 300 g/L.
.3 Roadway: 250 g/L.
.4 Single-Ply Roof Membrane: 450 g/L.
.5 Other: 420 g/L.

.5 Sealant Primers:
.1 Architectural, Nonporous: 250 g/L.
.2 Architectural, Porous: 775 g/L.
.3 Other: 750 g/L.

.2 Indoor Environmental Quality Credit EQ-4.2 Low-Emitting Materials: Paints and Coatings. Interior applications use paints and coatings must comply with the following limits for VOC content when calculated according to Green Seal Standard GS-11, Green Seal Standard GS-36. and SCAQMD Rule 1113.
.1 Interior Flat Coating or Primer: 50 g/L.
.2 Interior Non-Flat Coating or Primer: 150 g/L.
.3 Anti-Corrosive / Anti-Rust Paint: 250 g/L.
.4 Clear Wood Finishes - Lacquer: 550 g/L.
.5 Clear Wood Finishes - Sander Sealers: 350 g/L.
.6 Clear Wood Finishes – Varnish: 350 g/L.
.7 Clear Brushing Lacquer: 680 g/L.
.8 Floor Coatings: 100 g/L.
.9 Sealers and Undercoaters: 200 g/L.
.10 Shellac: clear: 730 g/L.
.11 Shellac: pigmented: 550 g/L.
.12 Stain: VOC not more than 250 g/L.
.13 Concrete-Curing Compounds: 350 g/L.
.14 Japans/Faux Finishing Coatings: 350 g/L.
.15 Magnesite Cement Coatings: 450 g/L.
.16 Pigmented Lacquer: 550 g/L.
.17 Waterproofing Sealers: 250 g/L.
.18 Waterproofing Concrete / Masonry Sealers: 400 g/L.
.19 Wood Preservatives: 350 g/L.
.20 Low-Solids Coatings: 120 g/L (incl. water)
.21 Aromatic Compounds: paints and coatings not to contain more than 1.0% by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
.22 Restricted Components: paints and coatings not to contain the following:
.1 Acrolein.
.2 Acrylonitrile.
.3 Antimony.
.4 Benzene.
.5 Butyl benzyl phthalate.
.6 Cadmium.
.7 Di (2-ethylhexyl) phthalate.
.8 Di-n-butyl phthalate.
.9 Di-n-octyl phthalate

.10 1,2-dichlorobenzene.
.11 Diethyl phthalate.
.12 Dimethyl phthalate.
.13 Ethylbenzene.
.14 Formaldehyde.
.15 Hexavalent chromium.
.16 Isophorone.
.17 Lead.
.18 Mercury.
.19 Methyl ethyl ketone.
.20 Methyl isobutyl ketone.
.21 Methylene chloride.
.22 Naphthalene.
.23 Toluene (methylbenzene).
.24 1,1,1-trichloroethane.
.25 Vinyl chloride.

.3 Indoor Environmental Quality Credit EQ-4.3 Low-Emitting Materials: Flooring System. Comply with CRI Green Label Plus program, FloorScore and SCAQMD Rule 1113.

.4 Indoor Environmental Quality Credit EQ-4.4 Low Emitting Materials: Composite Wood and Agrifiber Products. Do not use composite wood and agrifibre products that contain urea-formaldehyde resin.

1.08 REFRIGERANTS AND CLEAN-AGENT FIRE-EXTINGUISHING-AGENTS REMOVAL

.1 Prerequisite EA-3 Fundamental Refrigerant Management.
.1 Remove CFC-based refrigerants from existing HVAC and refrigeration equipment indicated to remain and replace with non CFC based refrigerants.
.2 Replace or adjust existing equipment to accommodate new refrigerant as described in Division 23.

1.09 CONSTRUCTION WASTE MANAGEMENT

.1 Credit MR-2.1 Construction Waste Management: Divert 80% From Landfill. Comply with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.10 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

.1 Refer to Section 01 47 18 for requirements of this credit.

.2 Credit EQ-3.1 Construction IAQ Management Plan: During Construction. Comply with SMACNA IAQ Guideline for Occupied Buildings under Construction.

.3 Obtain written approval from Consultant to operate permanent HVAC systems during construction. Operate permanent HVAC systems in accordance with Section 23 05 01 - Use of HVAC Systems During Construction. Install MERV-13 filter media in accordance with ASHRAE 52.2 at return-air inlets.

.1 Replace air filters immediately prior to building air flushout. Replacement air filters to be MERV 13 in accordance with ASHRAE 52.2.

.4 Credit EQ-3.2 Construction IAQ Management Plan: Testing Before Occupancy.

.1 Conduct 2-week building air flush-out upon construction completion with new air filters and 100 % outdoor air. Replace air filters after air flush-out. Replacement air filters to have a MERV 13 according to ASHRAE 52.2 or

.2 Conduct baseline indoor air quality testing program according to EPA Protocol for Environment Requirements, Testing for Indoor Air Quality Baseline IAQ and Materials.

.1 Payment for testing in accordance with Section 01 29 83 for Testing Laboratory Services. Testing services will be paid by Owner from the IAQ Testing Allowance.

.2 Employ independent testing and inspecting agency to conduct IAQ Testing.

END OF SECTION

LEED Canada-NC 2009 Project Checklist

GREEN GABLES NEW VISITOR CENTRE

Yes	?	No		
66	13	31	**Project Totals** (pre-certification estimates)	110 Possible Points

Certified 40-49 points **Silver** 50-59 points **Gold** 60-79 points **Platinum** 80 points and above

Yes	?	No			
12	0	14	**Sustainable Sites**		**26** Points
✓			Prereq 1	**Construction Activity Pollution Prevention**	Required
1			Credit 1	**Site Selection**	1
		5	Credit 2	**Development Density and Community Connectivity**	3, 5
		1	Credit 3	**Brownfield Redevelopment**	1
		6	Credit 4.1	**Alternative Transportation: Public Transportation Access**	3, 6
1			Credit 4.2	**Alternative Transportation: Bicycle Storage & Changing Rooms**	1
3			Credit 4.3	**Alternative Transportation: Low-Emitting & Fuel-Efficient Vehicles**	3
		2	Credit 4.4	**Alternative Transportation: Parking Capacity**	2
1			Credit 5.1	**Site Development: Protect and Restore habitat**	1
1			Credit 5.2	**Site Development: Maximize Open Space**	1
1			Credit 6.1	**Stormwater Design: Quantity Control**	1
1			Credit 6.2	**Stormwater Design: Quality Control**	1
1			Credit 7.1	**Heat Island Effect: Non-Roof**	1
1			Credit 7.2	**Heat Island Effect: Roof** *(80% of Gold project acheive - Slope roof SRI=29)*	1
1			Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
7	3	0	**Water Efficiency**		**10** Points
✓			Prereq 1	**Water Use Reduction**	Required
4			Credit 1	**Water Efficient Landscaping**	2, 4
	2		Credit 2	**Innovative Wastewater Technologies** *(36% of Gold project acheive)*	2
3	1		Credit 3	**Water Use Reduction**	2 - 4

Yes	?	No			
22	7	6	**Energy & Atmosphere**		**35** Points
✓			Prereq 1	**Fundamental Commissioning of Building Energy Systems**	Required
✓			Prereq 2	**Minimum Energy Performance**	Required
✓			Prereq 3	**Fundamental Refrigerant Management**	Required
13	2	4	Credit 1	**Optimize Energy Performance**	1 - 19
7			Credit 2	**On-Site Renewable Energy** *(6% of Gold project acheive)*	1 - 7
	2		Credit 3	**Enhanced Commissioning**	2
		2	Credit 4	**Enhanced Refrigerant Management**	2
	3		Credit 5	**Measurement and Verification** *(56% of Gold project acheive)*	3
2			Credit 6	**Green Power** *(47% of Gold project acheive)*	2

Yes	?	No			
3	0	11	**Materials & Resources**		**14** Points
✓			Prereq 1	**Storage and Collection of Recyclables**	Required
		3	Credit 1.1	**Building Reuse: Maintain Existing Walls, Floors, and Roof**	1 - 3
		1	Credit 1.2	**Building Reuse: Maintain Interior Non-Structural Elements**	1
		2	Credit 2	**Construction Waste Management** *(What is the alternate to landfill in that area?)*	1 - 2
		2	Credit 3	**Materials Reuse** *(3% of Gold project acheive)*	1 - 2
1		1	Credit 4	**Recycled Content**	1 - 2
1		1	Credit 5	**Regional Materials**	1 - 2
		1	Credit 6	**Rapidly Renewable Materials** *(0% of Gold project acheive)*	1
1			Credit 7	**Certified Wood**	1

Yes	?	No			
12	3	0	**Indoor Environmental Quality**		**15** Points
✓			Prereq 1	**Minimum Indoor Air Quality Performance**	Required
✓			Prereq 2	**Environmental Tobacco Smoke (ETS) Control**	Required
1			Credit 1	**Outdoor Air Delivery Monitoring**	1
1			Credit 2	**Increased Ventilation**	1
1			Credit 3.1	**Construction IAQ Management Plan: During Construction**	1
1			Credit 3.2	**Construction IAQ Management Plan: Before Occupancy**	1
1			Credit 4.1	**Low-Emitting Materials: Adhesives and Sealants**	1
1			Credit 4.2	**Low-Emitting Materials: Paints and Coatings**	1
1			Credit 4.3	**Low-Emitting Materials: Flooring Systems**	1
1			Credit 4.4	**Low-Emitting Materials: Composite Wood and Agrifibre Products**	1
1			Credit 5	**Indoor Chemical and Pollutant Source Control**	1
	1		Credit 6.1	**Controllability of System: Lighting**	1
	1		Credit 6.2	**Controllability of System: Thermal Comfort** *(45% of Gold project acheive)*	1
1			Credit 7.1	**Thermal Comfort: Design**	1
1			Credit 7.2	**Thermal Comfort: Verification** *(44% of Gold project acheive)*	1
	1		Credit 8.1	**Daylight and Views: Daylight**	1
1			Credit 8.2	**Daylight and Views: Views**	1

Yes	?	No			
6	0	0	**Innovation in Design**		**6** Points
1			Credit 1.1	**Innovation in Design**	1
1			Credit 1.2	**Innovation in Design**	1
1			Credit 1.3	**Innovation in Design**	1
1			Credit 1.4	**Innovation in Design**	1
1			Credit 1.5	**Innovation in Design**	1
1			Credit 2	**LEED® Accredited Professional**	1

Yes	?	No			
4	0	0	**Regional Priority**		**4** Points
	0		Credit 1	**Durable Building**	1
1			Credit 2.1	**Regional Priority Credit - SSc1 Site selection**	1
2			Credit 2.2	**Regional Priority Credit -** *other option SSc6.2, WEc2, EAc1/40%, EAc5, MRc2*	1
1			Credit 2.3	**Regional Priority Credit**	1

LEED® INFORMATION SUBMITTAL FORMS

GENERAL INFORMATION REQUIREMENTS

Product Name	Manufacturer's name
Submitted by (name and company)	Contact information

Total cost of this material: $_____

Cost of component (if it is a component of a larger assembly whose cost is given in the line above): $_____

Total value of all wood-based materials: $_____

MATERIAL REUSE AND SALVAGE

Is this material (in whole or in part) salvaged, refurbished, or reused? ❑ YES ❑ NO

What is the value of the salvaged, refurbished, or reused part of this material? $_____

If it is reused, use market replacement value.

Comments:

RECYCLED CONTENT

Does this material contain recycled content? ❑ YES ❑ NO

IF YES, PLEASE FILL IN THE FOLLOWING DETAILS:

Percent post-consumer recycled portion: _____%

Percent post-industrial recycled portion: _____%

Recycled content information source (describe and attach, i.e. manufacturer's literature):

NOTE: IF INFORMATION IS BEING PROVIDED ON AN ASSEMBLY (E.G. WINDOWS) PLEASE PROVIDE SEPARATE INFORMATION ON SEPARATE FORMS FOR THE COMPONENT PARTS (E.G. GLASS, FRAMES, FILMS) INCLUDING AN ESTIMATED BUDGET FOR EACH ASSEMBLY COMPONENT.

Comments:

REGIONAL MANUFACTURE AND HARVEST OF MATERIALS

Is this material manufactured locally, within 800 km (truck) / 2400 km (ship or rail) radius of the project site? ❑ YES ❑ NO

IF YES — What is the distance between project site and location of manufacture (km): _____

Primary mode of transport: ❑ TRUCK ❑ SHIP/RAIL

Is this material harvested/extracted locally, within 800 km (truck) / 2400 km (ship or rail) radius of the manufacture site? ❑ YES ❑ NO

IF YES — What is the distance between project site and location of harvest/extraction (km): _____

Primary mode of transport: ❑ TRUCK ❑ SHIP/RAIL

Regional manufacture and harvest information source(s):

RAPIDLY RENEWABLE MATERIALS

Is this material made from a rapidly renewable resource? ❑ YES ❑ NO

What is the value of the rapidly renewable portion? $_____

Rapidly Renewable resource information source (describe and attach i.e. manufacturer letter, map):

Comments:

CERTIFIED WOOD

Is this material a wood-based product or material? ❑ YES ❑ NO

If so, is it certified by the Forest Stewardship Council (FSC)? ❑ YES ❑ NO

If yes, give the vendor's FSC chain-of-custody certificate number: _____

CERTIFIED WOOD

What is the value of the FSC certified portion of this product or material? $_____

Certified wood information source(s) (describe and attach):

Comments:

LOW-EMITTING MATERIALS

Is this material an adhesive, sealant, sealant primer paint or other coating, flooring (ie. carpet, wood), composite wood/agrifibre, laminate adhesive product?	❑ YES	❑ NO
If yes, does it meet the emission limits described in Section 01.35-43 Environmental Procedures – Low Emitting Materials Emissions Limits Table	❑ YES	❑ NO
For all adhesive, sealant, paint or other coating what is the VOC level of the material:	_____ g/L	
For carpet products, what are the emission factor limits:	_____Mg/m2/h	
Does flooring comply with relevant standards as outlined in LEED Reference Guide? (ie. Carpet and Rug Institute Green Label Program, FloorScore, SCAQMD)	❑ YES	❑ NO
For composite wood and agrifibre products, does the material contain added urea-formaldehyde resin?	❑ YES	❑ NO

Low-emitting material information source(s) (describe and attach):

Comments:

Please return completed forms Attention:

NOTE THAT FORMS FOR MATERIALS RELATING TO INDOOR AIR QUALITY PROTECTION (THE LAST BOX) MUST BE SUBMITTED AND CHECKED **PRIOR** TO BEING INSTALLED.

END OF SECTION

1.01 REFERENCE STANDARDS

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

.2 Province of Prince Edward Island
- .1 Occupational Health and Safety Act, R.S.P.E.I. - Updated 2015.
- .2 Occupational Health and Safety Act, General Regulations, R.S.P.E.I. – Updated 2013.

1.02 ACTION AND INFORMATION SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan: Within 7 working 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.

.3 Submit three 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 and Provincial health and safety inspectors.

.5 Submit copies of incident and accident reports.

.6 Submit WHMIS MSDS - Material Safety Data Sheets for Products and materials to be incorporated into the Work.

.7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 working days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 working days after receipt of comments from Departmental Representative.

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

.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.

.10 On-site Contingency and Emergency Response Plan: in consultation with Departmental Representative, address standard operating procedures to be implemented during emergency situations.

1.03 FILING OF NOTICE

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

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

1.04 SAFETY ASSESSMENT

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

1.05 MEETINGS

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

1.06 REGULATORY REQUIREMENTS

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

1.07 GENERAL REQUIREMENTS

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

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

1.8 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.

1.9 COMPLIANCE REQUIREMENTS

.1 Comply with the following:
- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 Province of Prince Edward Island:
  - .1 Occupational Health and Safety Act, R.S.P.E.I. - Updated 2015.
  - .2 Occupational Health and Safety Act, General Regulations, R.S.P.E.I. – Updated 2013.

1.10 UNFORESEEN HAZARDS

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

1.11 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
- .1 Have site-related working experience specific to the Work of Contract.
- .2 Have working knowledge of occupational safety and health regulations.
- .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

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

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

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.

1.13 CORRECTION OF NON-COMPLIANCE

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

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

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

1.14 BLASTING

.1 Blasting or other use of explosives is not permitted.

1.15 POWDER ACTUATED DEVICES

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

1.16 WORK STOPPAGE

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

END OF SECTION

1 GENERAL

.1 Work of this Section will be performed in such a manner as to prevent environmental damage to watercourses and surrounding property.

.2 It is the responsibility of the Contractor to ensure that regulations respecting protection of the environment during Work of this Section are understood and followed. Obtain necessary permits and approvals from authorities having jurisdiction.

.3 Contractor is to provide environmental training for all of their workers on site. Training is to include a review of site specific procedures and management plans, including Sedimentation and Erosion Control, Construction Waste Management, and Environmental Protection

.4 It is emphasized that control of water and prevention of siltation is the responsibility of the Contractor. Payment for the installation of sediment traps, siltation fences, 50mm straw cover, granular pads, filter berms, sediment basins and all other measures required and mentioned later in the specifications will be considered incidental to the completion of the works.

2 SUBMITTALS

.1 Prior to commencing construction activities or delivery of materials to site, submit for review by Departmental Representative:
  .1 An Erosion & Sedimentation Control Plan
  .2 An Environmental Protection Plan.

.2 Update Erosion and Sedimentation Control Plan and Environmental Protection as required by weather and stage of construction or as directed by Departmental Representative. Submit updated plans for review by Departmental Representative.

.3 Provide LEED documentation in accordance with Submittal Procedures.

3 DEFINITIONS

.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.

.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

4 REFERENCE DOCUMENTS

.1 The following reference documents form a part of this specification:
- .1 Prince Edward Island – Department of Transportation, Infrastructure and Energy – General Provisions and Contract Specifications for Highway Construction.
- .2 PEI – Environmental Protection Act.
- .3 PEI – Watercourse and Wetland Protection Regulations.

5 PERMITS AND APPROVALS

.1 Obtain copies of any permits or approvals issued by approval agencies. Review and comply with all conditions contained in permit or approval. Ensure all staff and Subcontractors are aware of all terms and conditions.

.2 Where permits or approval are required and not obtained at time of bidding; be responsible for obtaining permits or approvals. The Activity Designation Regulations made under the Nova Scotia Environment Act list all activities which require an approval from the Nova Scotia Department of Environment.

6 EROSION CONTROL

.1 Contractor to prepare and submit within 5 days of award of Contract an Erosion and Sediment Control Plan (E&SC Plan) as per requirements for submission of Shop Drawings.

.2 Sediment and erosion control plan to conform to United States Environmental Protection Agency (EPA) Document No. EPA 832/R-92-005 (September 1992), Storm Water Management for Construction Activities, Chapter 3. Information on the U.S. EPA construction general permit is available at: http://cfpub.epa.gov/npdes/stormwater/cgp.cfm.

.3 The Plan shall meet the following objectives:
- .1 Prevent loss of soil during construction by stormwater runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
- .2 Prevent polluting the air with dust and particulate matter.
- .3 Prevent sedimentation of storm sewer or receiving streams.
- .4 E&SC Plan to be specific to the particular site. Contractor to demonstrate that they have reviewed the site and construction schedule, anticipated the E&SC problems and developed specific plans/actions/techniques/BMP to address.
- .5 A draft construction schedule is to be submitted as part of the E&SC Plan with specific references to how E&SC measures will be changed to address the changing construction site and anticipated weather schedule.
- .6 Plan to define daily, weekly and monthly activities to be undertaken with respect to E&SC. Also what is to be reviewed/undertaken before major storm events.

.4 Perform grading work to minimize the effects of erosion on site and as specified on Erosion and Sedimentation Control Plan.

.5 Install erosion control measures which meet or exceed those as specified in the NSDTIR Standard Specification for Highway Construction, current edition. Take additional measures to prevent erosion as required by site conditions or as directed by Nova Scotia Environment or authority having jurisdiction. Repair any damage which occurs as a result of erosion.

.6 Supply and maintain minimum 6.0m wide x 15.0m long x 0.20m thick long granular pads at exits to paved surfaces to reduce mud track-off. Inspect routinely and clean to remove sediment from granular pad as required or as direct by Departmental Representative to maintain effectiveness. Promptly clean existing street of track-off from construction activities to approval of Departmental Representative.

.7 Keep paved surfaces clean. Prevent dust to approval of Departmental Representative.

.8 Direct pumped water or runoff to control structures to allow particulate settlement prior to discharge to adjacent storm systems. Clean out structures on a regular basis so that sediment discharge is prevented.

.9 Provide filter berms or sand bags as required to retard and filter run-off prior to discharge to storm water system.

.10 Dispose of water so as not to be injurious to public health and safety, to property or to any part of work completed under construction.

.11 Keep gutters open at all times for surface discharge.

7 POLLUTION CONTROL

.1 Contractor to prepare and submit within 5 days of award of Contract an Environmental Protection Plan for review by Departmental Representative as per requirements for submission of Shop Drawings.

.2 Environmental Protection Plan is to present comprehensive overview of known or potential environmental issues which must be addressed during construction, is to address procedures to follow in the event of a pollution incident. Contractor to ensure that all staff are aware of these procedures.

.3 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.4 Environmental protection plan must include at a minimum:
- .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan;
- .2 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas;
- .3 Spill Control Plan including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.4 Air pollution control plan, detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.

.5 Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

.5 Immediately report any environmental emergency, such as an oil spill of a contaminant, to the Canadian Coast Guard Regional Operations Center Environmental Emergencies 1-800-565-1633.

.6 Maintain temporary pollution control device installed under this Contract until the Work is completed as specified in the Project Document. Remove control measures, if directed by the Departmental Representative, prior to project completion.

.7 Control emissions from equipment to requirements of authorities having jurisdiction and to approval of Departmental Representative.

8 PRODUCTS

.1 Geotextile:

.1 Geotextile fabrics for use in Erosion and Sedimentation control shall be to the following requirements:

.1 Siltation fencing to be Armtec Siltfence or approved equal.

.2 Geotextile to be non-woven polyester, Texel 7607, SI401, Terrafix 200 or approved equal.

.2 Plastic Sheeting

.1 Minimum 8 mil heavy duty polyethylene sheet plastic.

9 EXECUTION

.1 Materials On-Site

.1 Maintain a ready reserve on-site of sandbags, geotextile, silt fence netting, 8 mil sheet plastic, rope and steel posts and any other materials required for rapid installation to prevent siltation of storm water systems.

.2 Keep the reserve of materials accessible at all times and in a functional condition.
.3 Install in accordance with the drawings and reviewed E&SC Plan.

.2 Maintenance
.1 Regularly inspect to ensure that ponds or traps function adequately.
.2 Make any necessary repairs promptly to ensure compliance with reviewed E&SC Plan.

.3 Removal and Disposal
.1 Remove all trapped sediment and installed materials at regular intervals as required, and dispose in an acceptable location.
.2 Remove in a fashion so not to cause downstream siltation.

10 DRAINAGE

.1 Control disposal or runoff of water containing suspended materials or other harmful substances with use of siltation fences, sedimentation ponds, diversion ditches, silt curtains, sedimentation blankets, slope stabilization and the like, in accordance with required environmental regulations, permits or approvals and authorities having jurisdiction.

.2 Control the discharge of pumped water to allow for the removal of suspended solids. Direct discharge to lawn or other vegetated areas to allow for the settlement of solids from pumped water. Restore lawn and other vegetated areas to original conditions. Do not pump water containing suspended solids into waterways or ditches.

.3 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.4 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

11 PLANT PROTECTION

.1 Protect existing trees and plants from damage by Work of this Contract.
.1 Protect root systems within dripline of existing trees to remain. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.2 Cleanly cut roots that need to be removed as part of landscape construction with sharp hand cutting tools

.3 Cover soil roots exposed during landscape construction that are to be preserved with moist soil until grades necessary for permanent root coverage are re-established.

12 FIRES

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

13 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials on site. Dispose of waste offsite in authorized location.

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

14 HISTORICAL / ARCHAEOLOGICAL CONTROL

.1 Undertake work in compliance with the Municipal, Provincial and Federal Regulations.

.2 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor’s personnel and Departmental Representative.

.3 Notify Departmental Representative whenever historic artifacts are encountered.

15 NOTIFICATION

.1 The Departmental Representative will notify the Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor’s Environmental Protection plan. The Contractor: after receipt of such notice, shall inform the Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.

.2 The Departmental Representative may issue a stop order of work until satisfactory corrective action has been taken. No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

END OF SECTION

1.01 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.

1.02 HAZARDOUS MATERIAL DISCOVERY

.1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Departmental Representative.

.2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Departmental Representative.

.3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Departmental Representative.

1.03 NATIONAL PARKS ACT

.1 Perform Work in accordance with National Parks Act when projects are located within boundaries of National Park.

END OF SECTION

1.01 DEFINITIONS

.1 Corrective Action: Steps that are taken to remove the causes of an existing non-conformity or undesirable situation. The corrective action process is designed to prevent the recurrence of non-conformities or undesirable situations. It tries to make sure that existing non-conformities and situations do not happen again. It tries to prevent recurrence by eliminating causes.

.2 Hold Point: A mandatory verification point beyond which a Work Process cannot proceed without authorization by Departmental Representative. Hold Points may be nominated by Departmental Representative. The issuance of a Non-Conformance or Corrective Action report by Departmental Representative automatically creates a Hold Point for the Work Processes affected.

.3 Non-Conformance: When one or more characteristics of an installation fail to meet specified requirements, it is referred to as Non-conformance. When an installation deviates from specified requirements, it fails to conform. Non-conformance must be identified and rectified.

1.02 INSPECTION

.1 Allow Departmental Representative 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 instructions, or law of Place of Work. Identify and confirm Hold Points in consultation with Departmental Representative for each technical specification section. Prepare and submit for review and approval detailed list of Hold Points, organized by specification section number, to Departmental Representative 7 working days prior to commencement of Work on site.

.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 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. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.03 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be selected by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.

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

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

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative, Pay costs for retesting and re-inspection.

1.04 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.

1.05 PROCEDURES

.1 Notify appropriate agency and Departmental Representative four days 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.

1.06 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 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, it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative 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 Departmental Representative.

1.07 REPORTS

.1 Submit electronic copy in PDF format (one password protected and one editable version) of inspection and test reports to Departmental Representative.

.2 Provide printed or electronic copies to subcontractor of work being inspected or tested, or manufacturer or fabricator of material being inspected or tested, as the case may be.

1.08 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 and may be authorized as recoverable.

1.09 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 and as specified in specific Section.

.3 Prepare mock-ups for Departmental Representative 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 will assist in preparing schedule fixing dates for preparation.

.6 Remove mock-up at conclusion of Work or when acceptable to Departmental Representative.

.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.

1.10 MILL TESTS

.1 Submit mill test certificates as requested and as required of specification Sections.

1.11 EQUIPMENT AND SYSTEMS

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

END OF SECTION

1.1 REFERENCES

.1 ANSI/ASHRAE 52.2-2017: Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.2 ANSI/ASHRAE 62.1-2016: Ventilation for Acceptable Indoor Air Quality.

.3 EPA: EPA Protocol for Environmental Requirements, Testing for Indoor Air Quality Baseline IAQ.

.4 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

.1 SMACNA 008-2008 (Chapter 3), IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition.

1.2 SPECIAL PRACTICES

.1 Do not use permanent HVAC for demolition/construction site conditioning; provide means of temporary ventilation, with exhaust vented to the exterior, for work areas as required.

.2 Clean HVAC ducts within each work area after completion of the work in that work area.

.3 Fully seal all permanent HVAC air intake openings within demolition/construction areas immediately prior to entering work area for the purposes of demolition and construction.

.4 Use MERV 13 filers for ventilation systems during demolition/construction, and fully seal/tape around filter edges to prevent passage of contaminates through filter bypass at edges. Change filters frequently to ensure optimum filtration performance.

.5 Establish negative air pressure at work areas relative to adjacent occupied areas using portable fans and flex pipe as required; vent to exterior. Occupied areas to have positive air pressure relative to work areas. Adjust HVAC equipment as required.

.6 Vacuum clean work areas daily using HEPA filtered vacuum systems.

.7 Enclose and seal work areas while adhesives, paints and sealants are curing and off-gassing; provide adequate ventilation, vented to exterior.

.8 Use low-VOC adhesives, paints and sealants when available and suitable to purpose and conditions: coordinate with trade contractors as required to ensure compliance.

1.3 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN

.1 The intent of this plan is to prevent construction and future indoor air quality problems that may result from demolition/construction affecting the comfort and health of construction workers and building occupants.

.2 The provision of the Construction Indoor Air Quality Management Plan or IAQ Management Plan is the responsibility of the Contractor.

.3 Provide a fully developed IAQ Management Plan implemented through demolition/construction and pre-occupancy including the following activities:

.1 Meet or exceed the recommended Design Approaches in SMACNA 008 (Chapter 3) and other requirements as detailed in this specification during all construction activities. These design approaches shall be applicable for all buildings regardless of whether it is a new construction or renovation.

.2 Protect construction workers and building occupants from indoor air quality problems resulting from construction activities and building materials.

.3 Protect all stored and installed absorptive materials from moisture or dust, chemical and gas damage as specified in Section 01 61 00 - Common Product Requirements.

.4 Construction use of air handling units, heat recovery ventilators, fans or any associated equipment and systems for ventilation, heating, de-humidification, humidification, dust control or any other use is strictly prohibited.

.5 Replace all filtration equipment for air handling units, heat recovery ventilators and fans with new filter media at the end of construction.

.4 Provide the following submittals to the requirements of Section 01 33 00 - Submittal Procedures:

.1 IAQ Management Plan:

.1 Provide a draft documented IAQ Management plan in writing for review by the Consultant within 21 days of award of contract.

.2 The IAQ Management Plan submission is to include:

.1 Details of each management plan strategy including:
  .1 The Design Approaches in SMACNA 008 (Chapter 3) including:
    .1 HVAC Protection.
    .2 Identification of sources of odours, dust, other contaminants.
    .3 Identify construction activities likely to produce detectable odours and dust.
    .4 Classify potential IAQ problems by relative risk.
    .5 Identify available control options.
    .6 Select control measures.
    .7 Determine contingency measures for occupants that may have allergies or other sensitivity-enhancing pre-conditions.
    .8 Source Control procedures.
    .9 Pathway Interruption.
    .10 Housekeeping.
    .11 Scheduling.
    .12 Reporting.
  .2 Samples of reporting documents based SMACNA 008 (Chapter 3).
  .3 Methods for protecting all stored and installed absorptive materials from moisture or dust, chemical and gas damage.
  .4 Declaration that air handling units, heat recovery ventilators, fans or any associated equipment and systems will not be used during construction for ventilation, heating, de-humidification, humidification and dust control.
  .5 Schedule for filter replacement as a component of the building start-up and Commissioning.

.3 Format: submit 5 copies of reports, each in "D" ring binders, complete with index tabs for verification and review by Consultant.
.4 Make changes or additions to the draft IAQ Management Plan within the specified plan requirements to the satisfaction of the Consultant and reissue as final draft.
.5 Distribute the final IAQ Management Plan to all trades working on the site.

.2 Construction Reporting
.1 During the course of construction provide the following reporting to the Consultant for review:
.1 Photographs indicating the general conformance to the IAQ Management Plan.
.2 Completed Planning Checklist for all trades on the project indicating scheduling and the requirements of IAQ procedures with respect to scheduled construction activities for that week.
.3 Inspection sheets completed by the Site Superintendent reviewing that all trades completed the scheduled requirements of the IAQ procedures for that week including any deficiencies and corrective actions taken.
.2 Provide all reporting on a weekly basis unless otherwise approved by the Consultant during periods of low IAQ risk construction or low construction activity.

.5 Provide the following close out submittals to the requirements of Section 01 78 00 - Closeout Submittals:
.1 Provide all IAQ Management Plan submittals including the following:
.1 The final version of the Construction IAQ Management Plan.
.2 Digital copies of all weekly photographs in a CD ROM Format.
.3 All weekly planning checklists.
.4 All weekly inspection sheets.
.5 Format: submit 5 copies of closeout report, each in "D" ring binders, complete with index tabs for verification and review by Consultant.

.6 Provide the following activities specified to meet or exceed the recommended Design Approaches in SMACNA 008 (Chapter 3) during all construction activities. These design approaches shall be applicable for all buildings regardless of whether it is a new construction or renovation:

.1 HVAC Protection:

.1 Use of air handling units, heat recovery ventilators, fans or any associated equipment and systems for ventilation, heating, de-humidification, humidification, dust control or any other use during Construction is strictly prohibited.

.2 Seal off all supply, return and exhaust air system openings to prevent the accumulation of dust and debris in the systems at all times unless work is being completed on the immediate area of the system using plastic seals to the approval of the Consultant. This is to include overnight and longer work stoppages. All diffusers, grilles, and displacement ventilators are also to be sealed in plastic.

.3 Protect all stored and installed absorptive materials from moisture and dust, chemical and gas damage as specified in Section 01 61 00 - Common Product Requirements.

.4 Keep all operable doors on all air handling units closed at all times unless work is being completed on the immediate area of the system.

.5 Do not store construction or waste materials in Fan and Mechanical Rooms.

.6 Keep all construction areas clean and neat as specified elsewhere in this specification.

.7 Replace filtration equipment for air handling units, heat recovery ventilators and fans with new filter media at the end of construction.

.8 Where ducts become contaminated due to inadequate protection these ducts shall be cleaned professionally.

.2 Source Control:

.1 Use of low VOC products as specified elsewhere are to be utilized at all times.

.2 Restrict traffic volume and idling of motor vehicles where emissions could be drawn into the building.

.3 Direct fired construction heaters are not acceptable. Vent all construction heater products of combustion to the outdoors.
.4 Cycle heating equipment off when not being used or needed.
.5 Exhaust all pollution sources to the outside with portable fan systems ensuring exhaust does not re-circulate back into the building.
.6 Keep containers of wet products closed as much as possible. Cover and seal waste materials, which can release odour or dust.

.3 Pathway Interruption:
.1 Prevent dust from migrating to other areas with the use of dust curtains or temporary enclosures where applicable.
.2 Relocate pollutant sources as far away as possible from construction ventilation equipment, stored materials and areas occupied by workers when feasible. Any construction supply and exhaust systems that ventilate both areas where pollutant sources are being used and areas where they are not been used should be shut down or isolated during such activity with supplemental construction ventilation provided as required.
.3 Isolate during construction, areas of work to prevent contamination of clean or occupied areas. Utilize pressure differentials generated by mechanical means to prevent contaminated air from entering clean areas.
.4 Ventilate contaminated air from construction areas directly to the outside during installation of VOC emitting materials.

.4 Housekeeping:
.1 Cleaning activities are specified in Section 01 74 11, however provide special emphasis on HVAC equipment and building spaces to remove contaminants from the building prior to operation of any permanent ventilation equipment.
.2 Keep all coils, filters, fans and ductwork clean during installation as specified and clean all prior to performing the Testing, Adjusting and Balancing of the systems.

.3 During construction suppress dust with wetting agents or sweeping compounds. Use efficient and effective dust collecting methods such as a damp cloth, wet mop, and vacuums with particulate filters, or wet scrubbers.

.4 Remove accumulations of water inside the building during construction. Protect all porous materials such as insulation and ceiling tile from exposure to moisture.

.5 Scheduling:

.1 Schedule work to ensure dust emitting work does not coincide with installation of absorbent materials (ceiling tiles, gypsum wall board joint compound wet application, fabric furnishings, carpet and insulation, for example) that may act as 'sinks' for dust.

.2 Do not schedule any construction activities that would require the use of VOC or dust emitting activities during occupancy without the approval of the Consultant.

.3 Schedule all use of VOC emitting and high odorous materials before installing absorbent materials (ceiling tiles, gypsum wall board, fabric furnishings, carpet and insulation, for example) that may act as 'sinks' for VOCs, odours and other contaminants.

END OF SECTION

1.01 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.

1.02 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.03 DEWATERING

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

1.04 WATER SUPPLY

.1 Provide continuous supply of potable water for construction use.

.2 Pay for utility charges at prevailing rates.

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

1.05 TEMPORARY HEATING AND VENTILATION

.1 Provide and pay for 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 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.

.7 Permanent heating system of building, not to be used unless authorized in writing by the Departmental Representative. Be responsible for damage to heating system if use is permitted.

.8 On completion of Work for which permanent heating system is used, replace filters and replace bearing. Thoroughly clean permanent equipment used during construction.

.9 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.

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

1.06 TEMPORARY POWER AND LIGHT

.1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools and equipment as required.

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

.3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.

.4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.

.5 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.

1.07 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary telephone, fax, data hook up, lines and equipment as necessary for own use and use of Departmental Representative.

1.08 FIRE PROTECTION

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

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

1.09 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 sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

.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

1.01 REFERENCES

.1 Canadian General Standards Board (CGSB)
  .1 CAN/CGSB 1.189-2000, Exterior Alkyd Primer for Wood.
  .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 Canadian Standards Association (CSA International)
  .1 CSA-A23.1/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  .2 CSA O121-17, Douglas Fir Plywood.
  .3 CAN/CSA-S269.2-16, Access Scaffolding for Construction Purposes.
  .4 CAN/CSA-Z321-96(R2006), Signs and Symbols for the Occupational Environment.

.3 Public Works Government Services Canada (PSPC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as of: 2014-10-08.

.4 U.S. Environmental Protection Agency (EPA) / Office of Water
  .1 EPA 832/R-92-005 (September 1992), Storm Water Management for Construction Activities.

1.02 ACTION AND INFORMATION SUBMITTALS

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

.2 Product Data:

  .1 Submit manufacturer's instructions, printed product literature and data sheets for products and accessories specified, and include product characteristics, performance criteria, layout of temporary construction facilities, and finishes.

.3 Provide graphic design of each type of intended site sign for approval by Departmental Representative.

1.03 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 graveled 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.

1.04 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA S269.2.

.2 Provide and maintain scaffolding, ramps, ladders, and temporary stairs as required.

1.05 HOISTING

.1 Provide, operate and maintain hoists and cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.

.2 Hoists and cranes to be operated by qualified operator.

1.06 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.

1.07 CONSTRUCTION PARKING

.1 Parking is limited during seasonal operations; make arrangements with Departmental Representative for suitable staging areas and parking.

.2 Provide and maintain adequate access to project site.

1.08 SECURITY

.1 To the extent that existing security is compromised by the Work, make suitable arrangements with Departmental Representative to establish and maintain security at levels comparable to that in place before commencement of the Work.

1.09 CONTRACTOR'S SITE OFFICE

.1 Be responsible for and provide own site office, if required, including electricity, heat, lights and telephone. Locate site office as directed by Departmental Representative.

1.10 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.

.3 Locate site storage trailers where directed by Departmental Representative. Place in location of least interference with existing Facility operations.

.4 Material storage space on site is limited. Coordinate delivery to minimize storage period on site before being needed for incorporation into work.

1.11 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.

1.12 CONSTRUCTION SIGNAGE

.1 Upon request by Departmental Representative, erect a self supporting project sign in location indicated.

.2 Departmental Representative will provide a vinyl sign facing for installation by Contractor on sign framework. Sign frame to be plywood face of approximately 1200 x 2400 mm in size complete with required wood framing at 400 mm on center and support posts.

.3 Install sign plumb and level in neat wood framework and securely anchor in ground by posts to withstand wind pressure of 160 km/h.

.4 Contractor or subcontractor advertisement signboards are not permitted on site.

.5 Safety and Instruction Signs and Notices:
.1 Signs and notices for safety and instruction shall be in both official languages or commonly understood graphic symbols conforming to CAN3-Z321-96(R2006).

.6 Maintenance and Disposal of Site Signs:
.1 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.

1.13 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.

.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.

.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.

1.14 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.

END OF SECTION

1.01 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.02 HOARDING

.1 Erect temporary site enclosures using 38 x 89 mm construction grade lumber framing at 600 mm centres and 1200 x 2400 x 13 mm exterior grade fir plywood in accordance with the requirements of Section 06 10 00 – Rough Carpentry.

.2 Apply plywood panels vertically flush and butt jointed. Prime and finish paint as directed by Departmental Representative.

.3 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.

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

.5 Paint public side of site enclosure in selected colours with one coat exterior alkyd primer for wood and one coat alkyd exterior gloss enamel in accordance with requirements of Section 09 91 00 - Painting. Maintain public side of enclosure in clean condition.

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

1.03 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 other conditions that present a fall hazard.

.2 Provide as required by governing authorities.

1.04 ACCESS TO SITE

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

1.05 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.

1.06 FIRE ROUTES

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

1.07 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.

1.08 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.

END OF SECTION

1.01 REFERENCES

.1 Within text of each specifications section, reference may be made to reference standards. List of standards reference writing organizations is contained in National Building Code of Canada (Code) and amendments up to date of Tender submission, including codes, standards, other documents and authorities as referenced by the Code.

.2 Conform to these reference standards, in whole or in part, as specifically requested in specifications.

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

.4 Cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.02 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.

1.03 AVAILABILITY

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

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

1.04 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 and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

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

.8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

.9 Touch-up damaged factory finished surfaces to match adjacent undamaged finish. Use touch-up materials to match original. Do not paint over name plates.

1.05 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 Departmental Representative. Unload, handle and store such products.

1.06 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 in writing of conflicts between specifications and manufacturer's instructions so that Departmental Representative can establish course of action.

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

1.07 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 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 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, whose decision is final.

1.08 COORDINATION

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

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

1.09 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 if there is interference. Install after interference has been resolved at instruction of Departmental Representative.

1.10 REMEDIAL WORK

.1 Refer to Section 01 73 00 - Execution Requirements.

.2 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.

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

1.11 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Departmental Representative of conflicting installation. Install after conflict resolved as approved by Departmental Representative.

1.12 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.

1.13 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.

1.14 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.

1.15 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, site staff, and pedestrian and vehicular traffic.

.2 Comply with requirements of Section 01 14 00 – Work Restrictions, and Section 01 51 00 – Temporary Utilities.

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

END OF SECTION

1.01 REFERENCES

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

1.02 QUALIFICATIONS OF SURVEYOR

.1 Engage the services of a qualified registered land surveyor.

.2 Qualifications: registered land surveyor licensed to practise in Place of Work, acceptable to Departmental Representative.

1.03 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 Departmental Representative.

.4 Report to Departmental Representative 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.

1.04 SURVEY REQUIREMENTS

.1 If acceptable control points or bench marks cannot be located on site, establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.

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

.3 Stake for grading, fill and topsoil placement and landscaping features.

.4 Stake slopes and berms.

.5 Establish pipe invert elevations.

.6 Stake batter boards for foundations.

.7 Establish foundation column locations and floor elevations.

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

1.05 EXISTING SERVICES

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

.2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

1.06 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.

1.07 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.

1.08 ACTION AND INFORMATION SUBMITTALS

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

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

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

1.09 SUBSURFACE CONDITIONS

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

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

END OF SECTION

1.01 ACTION AND INFORMATION 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 Departmental Representative 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 Owner or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.02 MATERIALS

.1 Required for original installation.

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

1.03 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.

1.04 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 Remove samples of installed Work for testing when required by Specifications.

.6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

.9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

.10 Restore work with new products in accordance with requirements of Contract Documents.

.11 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.12 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with fire stopping material in accordance with Section 07 84 00 – Fire Stopping, full thickness of the construction element.

.13 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

.14 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.05 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.

END OF SECTION

1.01 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.

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

.3 Clear snow and ice from access to building, bank/pile snow in designated areas only, and remove from site when snow accumulation exceeds boundaries of designated areas.

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

.5 Provide on-site containers approved by Departmental Representative 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 in accordance with federal, provincial and local requirements and regulations.

.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.

1.02 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.

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

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

.7 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 fitments, walls, floors and other exposed surfaces.

.09 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, fitments 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.

1.03 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.

END OF SECTION

1.01 WASTE MANAGEMENT REQUIREMENTS

.1 Prior to start of Work, conduct meeting with Consultant to review and discuss Waste Management Plan.

.2 Waste Management Requirements: Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.

.3 The Contractor shall be responsible for the Material Recovery Plan, Waste Reduction Plan and Construction Management Plan, as required by the municipality. This information shall be submitted to the appropriate department of the municipality for approval prior to commencement of Work by the Contractor.

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

.5 Protect environment and prevent environmental pollution damage.

1.02 REFERENCE STANDARDS

.1 Canadian Construction Association (CCA)
- .1 CCA 81-2001: A Best Practices Guide to Solid Waste Reduction.

.2 Public Works and Government Services Canada (PSPC)
- .1 2002 National Construction, Renovation and Demolition Non-Hazardous Solid Waste Management Protocol.
- .2 CRD Waste Management Market Research Report (available from PSPC's Environmental Services).
- .3 Sustainable Development Strategy 2007-2009: Target 2.1 Environmentally Sustainable Use of Natural Resources.
  - .1 Real Property projects over $1 million and in communities where industrial recycling is supported, implementation of CRD waste management practices will be completed, with waste materials being reused or recycled.
  - .2 Contractually ensure resources used in construction or maintenance are consumed and recovered in a sustainable manner.

.3 Section 01 35 13.13 - Special Procedures for National Historic Sites.

1.03 DEFINITIONS

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

.2 Demolition Waste Audit (DWA): relates to actual waste generated from project.

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

.4 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.

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

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

.7 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.

.8 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.

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

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

.11 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.

.12 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.

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

.14 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).

1.04 DOCUMENTS

.1 Post and maintain in visible and accessible area at job site, one copy of following documents:
- .1 Waste Audit.
- .2 Waste Reduction Workplan.
- .3 Material Source Separation Plan.
- .4 Schedules A, B, and C completed for project.

1.05 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prepare and submit following prior to project start-up:
- .1 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 completed Demolition Waste Audit (DWA): Schedule C.
- .4 Submit 2 copies of Materials Source Separation Program (MSSP) description.

.3 Prepare and submit on monthly basis throughout project or at intervals agreed to by Departmental Representative the following:
.1 Receipts, scale tickets, waybills, and/or waste disposal receipts that show quantities and types of materials reused, recycled, or disposed of.
.2 Written monthly summary report detailing cumulative amounts of waste materials reused, recycled and landfilled, and brief status of ongoing waste management activities.

.4 Submit prior to final payment the following:
.1 Waste Diversion Report, indicating final quantities in tones by material types salvaged for reuse, recycling or disposal in landfill and recycling centres, re-use depots, landfills and other waste processors that received waste materials (See Schedule C).
.2 Provide receipts, scale tickets, waybills, waste disposal receipts that confirm quantities and types of materials reused, recycled or disposed of and destination.

1.06 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.

1.07 WASTE REDUCTION WORKPLAN (WRW)

.1 Prepare WRW prior to project start up.

.2 WRW should include:
.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 Describe management of waste.

.4 Identify opportunities for reduction, reuse, and recycling of materials. Based on information acquired from WA.

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

.6 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.

.7 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.

1.08 DEMOLITION WASTE AUDIT (DWA)

.1 Prepare DWA prior to project start up.

.2 Complete DWA: Schedule C.

.3 Provide inventory of quantities of materials to be salvaged for reuse, recycling, or disposal.

1.09 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 Consultant.

.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 materials in areas which minimize material damage.

.7 Collect, handle, store on site, and transport off site, salvaged materials in separate condition.

.8 Collect, handle, store on site, and transport off site, salvaged materials in combined condition.

1.10 USE OF SITE AND FACILITIES

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

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

1.11 WASTE PROCESSING SITES

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

1.12 QUALITY ASSURANCE

.1 After award of Contract, a mandatory site examination will be held for this Project for Contractor and sub-contractors responsible for construction, renovation demolition/deconstruction waste management.
.1 Date, time and location will be arranged by Departmental Representative.

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

1.13 STORAGE, HANDLING AND PROTECTION

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

.2 Unless specified otherwise, materials for removal become Contractor's property.

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

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

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

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

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

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

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

.10 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.
- .1 On-site source separation is recommended.
- .2 Remove co-mingled materials to off site processing facility for separation.
- .3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.
- .4 Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

1.14 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

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

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

.4 Remove materials from site as Work progresses.

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

1.15 SCHEDULING

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

1.16 APPLICATION

.1 Do Work in compliance with WRW.

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

1.17 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
.1 Leave Work area clean at end of each day.

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
.2 Source separate materials to be reused/recycled into specified sort areas.

1.18 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 DCC Representative Consultant, and consistent with applicable fire regulations.
.1 Mark containers or stockpile areas.
.2 Provide instruction on disposal practices.

.2 On-site sale of salvaged, recovered, reusable, recyclable materials is not permitted unless approved in writing by Departmental Representative.

1.19 WASTE DIVERSION REPORT

.1 At completion of Project, prepare written Waste Diversion Report indicating quantities of materials reused, recycled or disposed of as well as the following:
- .1 Identify final diversion results and measure success against goals from Waste Reduction Workplan.
- .2 Compare final quantities/percentages diverted with initial projections in Waste Audit and Waste Reduction Workplan and explain variances.
  - .1 Supporting documentation.
  - .2 Waybills and tracking forms.
  - .3 Description of issues, resolutions and lessons learned.

1.20 SCHEDULES

.1 Following Schedules are attached to this Specification for information and convenience only:
- .1 Waste Audit - Schedule A.
- .2 Waste Reduction Workplan Form - Schedule B.
- .3 Demolition Waste Audit - Schedule C.

END OF SECTION

Schedule A Waste Audit (WA)

Material Category	Material Quantity Unit	Estimated Waste %	Total Quantity of Waste (unit)	Generation Point	% Recycled	% 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						

Schedule B Waste Reduction Workplan (WRW)

Material Category	Person(s) Responsible	Total Quantity of Waste (unit)	Reused Amount (units) Projected	Actual	Recycled Amount (unit) Projected	Actual	Material(s) Destination
Wood and Plastics Material Description							
Chutes							
Warped Pallet Forms							
Plastic Packaging							
Cardboard Packaging							
Other							
Doors and Windows Material Description							
Painted Frames							
Glass							
Wood							
Metal							
Other							

Schedule C Demolition Waste Audit (DWA)

Material Description	Quantity	Unit	Total	Volume (cum)	Weight (cum)	Remarks and Assumptions
Wood						
Wood Stud						
Plywood						
WD Baseboard						
WD Door Trim						
Cabinet						
Doors and Windows						
Panel Regular						
Slab Regular						
Wood Laminate						
Bi-fold - Closet						
Glazing						

1.01 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 in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
    .2 Request Departmental Representative inspection.
  .2 Departmental Representative Inspection:
    .1 Departmental Representative 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 Certificates required by authorities having jurisdiction: submitted.
    .5 Operation of systems: demonstrated to Owner's personnel.
    .6 Work: complete and ready for final inspection.
  .4 Final Inspection:
    .1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.
    .2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

1.02 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.

END OF SECTION

1.01 ADMINISTRATIVE REQUIREMENTS

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

1.02 ACTION AND INFORMATION SUBMITTALS

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

.2 Prepare and submit Operations and Maintenance Manual, which shall include manufacturer’s brochures and technical datasheets, MSDS, as-built drawings, maintenance and operating instructions, etc., as specified in this Section

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

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

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

1.03 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. 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 dwg format on CD or DVD, and flash drive.

1.04 CONTENTS - PROJECT RECORD DOCUMENTS

.1 Table of Contents for Each Volume: provide title of project;
.1 Date of submission; names.
.2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:
.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

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

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

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

.6 Training: refer to Section 01 79 00 - Demonstration and Training.

1.05 AS-BUILT DOCUMENTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative 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.

1.06 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Departmental Representative.

.2 Use felt fine-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 Referenced Standards 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 for site records.

1.07 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.

1.08 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.

1.09 MATERIALS AND FINISHES

.1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
  .1 Provide information for re-ordering custom manufactured products.

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

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

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

1.10 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 site; place and store.
  .4 Receive and catalogue items.
    .1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

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

.2 Extra Stock Materials:

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

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

.3 Deliver to site; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

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

.3 Special Tools:

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

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

.3 Deliver to site; 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 approval.

.3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.

.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.

.6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
- .4 Verify that documents are in proper form, contain full information, and are notarized.
- .5 Co-execute submittals when required.
- .6 Retain warranties and bonds until time specified for submittal.

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

.8 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Departmental Representative.

.9 Include information contained in warranty management plan as follows:
- .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
- .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and systems such as fire protection, alarm systems, etc..
- .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 4 and 9 month post-construction warranty inspections.
- .5 Procedure and status of tagging of equipment covered by extended warranties.
- .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

.10 Respond in timely manner to oral or written notification of required construction warranty repair work.

.11 Written verification to follow oral instructions.
.1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.13 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of acceptance until project is accepted for occupancy.

.4 Indicate following information on tag:
.1 Type of product/material.
.2 Model number.
.3 Serial number.
.4 Contract number.
.5 Warranty period.
.6 Inspector's signature.
.7 Construction Contractor.

END OF SECTION

1.01 ADMINISTRATIVE REQUIREMENTS

.1 Demonstrate at agreed times operation and maintenance of equipment and systems to personnel identified by Departmental Representative two weeks prior to date of interim completion.

.2 Departmental Representative: 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 in accordance with Section 01 77 00 - Closeout Procedures.
- .4 Ensure testing, adjusting, and balancing has been performed in accordance with Section 01 77 00 - Closeout Procedures 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 agreed upon 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.

.5 Time Allocated for Instructions: ensure amount of time required for instruction of each item of equipment or system as follows:
.1 Pumps: 1 hour instruction.
.2 Tanks: 1 hour instruction.
.3 Plumbing: 2 hours instruction.
.4 Chemical: 1 hour instruction plus monthly visits.
.5 Fire Protection: 1 hour instruction.
.6 Glycol: ½-hour instruction.
.7 Air Handling: 1 hour instruction.
.8 Controls: 40 hours (overall) instruction and support as required during the first year following certificate of Substantial Performance.

1.02 ACTION AND INFORMATION 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 agreed dates, for Departmental Representative's 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.

1.03 QUALITY ASSURANCE

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

END OF SECTION

1.01 RELATED SECTIONS

.1 Closeout Submittals: Section 01 78 00

.2 Demonstration and Training: Section 01 79 00

1.02 BACKGROUND INFORMATION

.1 Building will be commissioned to meet the requirements of the LEED® 2009 Green Building Rating system for Fundamental Commissioning of Building Energy Systems. Commissioning (or the commissioning process), as understood by PSPC, is a planned program of activities conducted in concert with other activities performed during each stage of project delivery.
   .1 The commissioning process identifies issues during the Planning and Design stages which are addressed during the Construction and Occupancy Stages of a Facility to ensure that the built facility is constructed and proven to operate satisfactorily under all weather, environmental and occupancy conditions to meet operational and user requirements.
   .2 Commissioning activities during the Construction stage incorporates a third party verification process and a transfer of critical operational knowledge to Facility personnel.

.2 Commissioning to occur during the construction stage and the early period of facility occupancy stage.

1.03 DEFINITIONS

.1 For the purpose of this contract, the various terms listed below, as they relate directly or indirectly to the commissioning process, shall be deemed to have the following meaning.

.2 Commissioning Process: a planned program of tasks, activities and procedures carried out systematically during the Construction and Occupancy Stages in accordance with the commissioning objectives to:
   .1 Verify whether the fully installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and;
   .2 Ensure that appropriate documentation is compiled to effectively train O& M staff and prepare a comprehensive Building Management Manual (BMM).

.3 Commission (i.e., to commission a building component or system): tests and checks conducted by Commissioning Agent on all systems and integrated systems of Facility; carried out only after they

are fully installed, functional and Contractor's Performance Verification responsibilities have been completed and approved.

.1 Contractor provides assistance during this process by operating equipment and systems, by troubleshooting and making adjustments as may be required.

.2 Systems are run under their full operation and under various modes to determine if they function correctly, consistently, at peak efficiency and interactively with each other as intended in accordance with Contract Documents and design criteria.

.3 During these checks, adjustments may be made enhancing performance to meet environmental or user requirements.

.4 Commissioning Agent: an appointed person, representing the Departmental Representative, responsible for the development of a Commissioning Plan and managing its implementation by overseeing and coordinating various activities and responsibilities to be performed by members of the Commissioning Team.

.1 In this project, the Commissioning Agent is part of the engineering consultant firm engaged by PSPC to prepare the final design and contract documents for this Work.

.2 Commissioning Agent plays a lead role in support to the Departmental Representative to ensure that the commissioning objectives are achieved.

.5 Commissioning Manager: a PSPC departmental employee providing advice and guidance on commissioning requirements to the Commissioning Agent in support to the Departmental Representative.

.1 Commissioning Plan: The document which describes the organization, scheduling, allocation of resources, required documentation, target dates, and team roles and responsibilities for verification that the built works meet Contract Document and design criteria requirements.

.2 Contractor: means the General Contractor, however it also refers to any personnel from subcontractors, including the controls and TAB specialists, suppliers and manufacturer's technical persons which Contractor employs to carry out his/her designated commissioning duties and activities. The Contractor is responsible for the performance of their subcontractors.

.3 Design Consultant: persons from the civil, architectural, mechanical and electrical design disciplines of the engineering firm(s) which have been engaged by the Departmental Representative to prepare the final design and produce the contract documents. Design Consultant also has specifically identified commissioning activities for this project.

.4 Design Criteria: All those factors included in the design

of a Facility prescribed by the tenant needs or as determined by the Design Consultant as necessary in order to meet all Facility functional and user operational requirements.

.5 Installation/Start-up Checks (sometimes referred to as pre-functional checks): a written compilation of checks and inspections to be performed by Contractor during the pre-start-up and start-up of a particular equipment or system component.

.6 Checklist sheets are produced which include the following data:

.1 Product manufacturer's installation instructions and recommended checks and;

.2 Special procedures as specified in relevant sections of Specifications;

.3 Other items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.7 Standard Installation/Start-up Checklist sheets prepared by equipment manufacturer are acceptable for use. However, supplement with additional data representative of specific project conditions as deemed required by Commissioning Agent.

.8 Use Checklist sheets for all equipment installation. Document in writing on checklist the various checks made, deficiencies noted and corrective action taken.

.9 Installer to sign Checklist sheets upon completion, certifying that stated checks and inspections have been performed.

.10 Use of Installation/Start-up Checklists is not considered part of the commissioning process but will be stringently used for all equipment pre-start and start-up procedures.

.11 Return completed Installation/Start-up Checklist sheets after use to Commissioning Agent for retention. Checklists are required by Commissioning Agent when Facility is commissioned and will be included in the BMM manual at completion of project.

.12 Contractor to submit blank forms to Commissioning Agent before performing start-up. Sample forms (see forms 01 91 32A through H) may be used to develop equipment specific forms.

.6 Performance Verification: (sometimes referred to Functional Testing) checks, running dynamic tests and adjustments carried out by Contractor on equipment and systems, upon their installation, to ensure they operate correctly, efficiently and function independently and interactively with other systems as intended in accordance with contract documents and manufacturer's recommendations.

.1 Performance Verification will not be considered part of the commissioning process. It is however considered an essential and integral part of Contractor's responsibilities in the equipment installation process which must be stringently conducted, successfully completed and approved by Departmental Representative before a piece of equipment or system is considered fully installed and functional.
.2 Facility components and systems will not be commissioned by Commissioning Agent until performance verification has been completed and approved.

.7 Performance Verification Report Sheets (PV sheets): forms developed by Commissioning Agent for Contractor's use to record measured data and readings taken during functional testing and Performance Verification procedures. Equipment specific forms will be issued by Commissioning Agent after shop drawing review.

.8 Product Information (PI Data): a compilation of data gathered on a particular piece of equipment, typically produced by manufacturer, which includes nameplate information, installation/startup instructions, parts list, operating instructions, maintenance guidelines and other pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of such equipment. This documentation is included in the Building Management Manual (BMM) at completion of work.

1.04 COMMISSIONING OBJECTIVES

.1 A Commissioning Plan has been prepared by the Commissioning Agent, on behalf of PSPC, which identifies, among other issues, specific commissioning activities to be carried out by the commissioning team during the Construction of the project.

.2 The commissioning activities have the following objectives:
.1 Collect data on equipment and systems being supplied and document their installation;
.2 Conduct checks and tests on fully installed building components, equipment, systems and integrated systems to:
.1 Verify whether they operate in accordance with requirements of Contract Documents;
.2 Verify performance against design criteria and user requirements and measure peak capacities;
.3 Prepare a Building Management Manual (BMM) which contains operations and maintenance data, as-built record documents, commissioning reports, training data and other critical information for future use by Facility operational staff;
.4 Ensure transfer of knowledge on the operations, maintenance

and management of the Facility to Tenant and Operational personnel by means of appropriate training.

.3 Work to achieve the above objectives requires a collaborative effort from all members of the commissioning team.
.1 Contractor's commissioning activities and responsibilities are described in Clause 1.07 below.

.4 Commissioning activities performed by the Commissioning Agent and the Design Consultant does not replace checks, tests, adjustments, balancing and other performance verification procedures to be carried out by the Contractor as an integral part of performing the Work of this contract as specified in other sections of the Specifications.

1.05 SYSTEMS TO BE COMMISSIONED

.1 The following systems and controls, complete with associated equipment and components, will be commissioned by the Commissioning Agent and requires related commissioning activities to be performed by Contractor as specified herein and in section(s):
.1 Air Handling Systems
.2 Heating Controls
.3 Plumbing Fixtures
.4 Fire Dampers
.5 TAB
.6 Branch Circuit Panelboards
.7 Disconnects - Fused and Unfused
.8 Emergency Lighting Battery Unit
.9 Exit Sign
.10 Lighting
.11 PV panels

1.06 COMMISSIONING TEAM

.1 A commissioning team will be assembled to carryout various functions needed to effectively commission the Facility. Contractor will be part of this team with duties and responsibilities as specified in this section and in other sections of the Specifications.

.2 Members of the Commissioning Team are as described in 01 91 31 - Commissioning Plan.

1.07 CONTRACTOR'S COMMISSIONING ACTIVITIES

.1 Organize and arrange for the services of subcontractors, their specialists and manufacturer's technical representatives to perform Contractor's commissioning activities.

.2 Confirm personnel forming part of the Commissioning Team are qualified and knowledgeable of installed equipment and systems and with design intent.

.3 Develop in conjunction with the Commissioning Agent a commissioning schedule as specified herein.

.4 Notify Departmental Representative in writing when Facility is ready for be commissioned. Give 14 calendar day notice.

.5 Commissioning will only commence once that full documentation has been received and installed equipment and systems have undergone successful performance verification.

.6 Note that Certificate of Substantial Completion will only be issued when:
- .1 All commissioning documentation has been received and found suitable by Departmental Representative;
- .2 Designated equipment and systems have been commissioned and;
- .3 Training has been completed.

.7 Performance faults:
- .1 Equipment and systems found not operating correctly or not performing as intended during commissioning shall be re-verified by checking 100% of all equipment and components of the un-functional system, including related controls as required to rectify the deficiencies and ensure correct performance.
- .2 Costs to conduct additional tests and inspections, as deemed required by Departmental Representative, to determine acceptability and proper performance of such item to be paid for by Contractor.

.8 Prior to Facility being Commissioned:
- .1 Submit commissioning documentation as specified in clause 1.12 below.
- .2 Submit the Installation/Start-up Checklist sheets to Commissioning Agent for review prior to conducting the pre-start and start-up of any piece of equipment. Incorporate additional start-up instructions onto checklist as determined by the Commissioning Agent's review.
- .3 Conduct the pre-start and start-up of all equipment by following and filling out the approved Installation/Start-up Checklists.
- .4 Conduct Performance Verification on all installed equipment and systems. Use and fill out the PV Report Sheets provided.
- .5 Upon completion of start-up and performance verification process, submit signed copy of Checklist and PV sheets to

Commissioning Agent as affidavit that required checks and tests were successfully conducted.

.6 Record performance measurements and data reading on PV sheets and return to Commissioning Agent for compilation.

.7 Give Departmental Representative and Commissioning Agent a minimum of five (5) days' notice for start-up and performance verification of equipment and systems which must be witnessed by Commissioning Agent as determined by Commissioning Agent beforehand on PV sheets.

.8 Provide missing information and data as identified by Commissioning Agent and Departmental Representative during documentation review.

.9 Submit above noted documentation before Commissioning will proceed.

.10 Address deficiencies in Work identified during performance verification of equipment and systems. Conduct additional performance verification thereafter.

.11 Arrange for special tools and devices, identified at commissioning meeting(s), as deemed required to assist with commissioning.

.12 Provide access ladders, two way radios and other equipment required by Team when facility will be commissioned.

.9 When Facility is being Commissioned:

.1 Provide qualified tradespersons to be present at site to assist Commissioning Agent.

.2 Assist in commissioning systems specified and as follows:

.1 Operate designated building component, mechanical/electrical equipment and system under all modes of operation and conduct checks and tests as directed by Commissioning Agent.

.2 Check and verify that building component, equipment, systems and integrated systems, including their controls, are functioning and responding correctly and interactively with each other.

.3 Test systems independently and then in unison with other related systems.

.4 Conduct all Commissioning checks and tests in presence of and witnessed by Commissioning Agent and Departmental Representative.

.5 Assist Design Consultant and other members of the commissioning team who will also be present to commission Facility.

.3 Specific procedures used to commission Facility will be provided by Commissioning Agent which includes:

.1 Sequential order of building component and system to be tested.

.2 Running systems under various anticipated modes and demands (example: high and low cooling or heating

loads, duplicating outside temperature conditions, fire alarm and power failure conditions).
.3 Running building controls through all sequences of operation to verify and confirm that equipment and systems are responding as designed and intended.
.4 Operating designated equipment at peak capacities, recording output data against design criteria.
.5 Run component or systems as long as necessary to effectively commission all items as deemed required by Commissioning Agent and Departmental Representative.
.6 Monitor equipment and system responses.
.7 Record test results, measurements and other data on commissioning forms provided by Commissioning Agent.
.8 Assist in analyzing results. Identify system deficiencies and components not responding as intended.
.9 Correct deficiencies and system non-conformance issues. Adjust, calibrate or fine tune system components as required. Debug system software as may be required.
.10 Retest systems when directed to confirm compliance.

.10 Upon completion of Facility Commissioning:
.1 Provide training to maintenance & operational personnel as specified.
.2 Turn over any filled-in checks sheets or reports resulting from commissioning.

1.08 COMMISSIONING ACTIVITIES OF OTHER TEAM MEMBERS

.1 Commissioning Agent:
.1 Represents the Departmental Representative during the commissioning process.
.2 Coordinates activities of the commissioning team members to ensure that commissioning activities are carried out properly and in a timely manner.
.3 Prepares commissioning schedule in concert with Contractor.
.4 Chairs commissioning meetings.
.5 Works with Contractor, subcontractors, equipment suppliers, Design Consultant resources, PSPC and Tenant Representatives to resolve technical problems which may arise during the process.
.6 Witnesses Contractor's pre-start, start-up and performance verification procedures for certain equipment and systems specified when deemed required due to their critical nature and function in the Facility.
.7 Verifies that Installation/Start-up Checklists and Performance Verification checks and tests are used and stringently followed by Contractor.
.8 Assists Contractor in coordination of training activities

for facility staff.
.9 Submits final commissioning report to Departmental Representative.

.2 Design Consultant (referred to as the "Departmental Representative" throughout the technical sections):
.1 Prepares in concert with Commissioning Agent the Commissioning Plan.
.2 Reviews Contractor's Installation/Start-up Checklists for completeness, incorporating supplement data not addressed on checklist. Provides to Contractor checklist for products which manufacturer does not provide installation and start-up instructions.
.3 Develops performance verifications report sheets for use by Contractor to record actual data and measurements against design data criteria.
.4 Includes, on performance verification report sheets, design data and anticipated performance values for equipment and systems to undergo verification.
.5 Compiles commissioning documentation submitted by Contractor. Prepares final Building Management Manuals.
.6 Assists Commissioning Agent in witnessing pre-start, start-up and performance verification activities.
.7 Approves type and method of calibration for instruments used by Contractor to conduct performance verification and commissioning tests.
.8 Assists Commissioning Agent in reviewing and analyzing tests results.
.9 Participate in the training sessions provided by Contractor to tenant O&M staff by giving introductory information on design philosophy, design intent and systems designs,
.10 Assist in the resolution of issues relating to commissioning.

.3 Tenant Representative:
.1 Participates with other team members to ensure that systems as installed meet the operational and functional requirements.
.2 Periodically attends commissioning meetings as required.
.3 Attends final commissioning activities.
.4 Assists in resolving technical problems by providing additional details on operational requirements.

.4 Facility Operations and Maintenance Staff:
.1 Participates in the commissioning process to obtain early introduction to the facility systems and to provide early operator feedback.
.2 Prime interest is in the familiarization and training of appropriate maintenance staff.

.3 Staff may attend certain critical equipment start-up and performance verification activities and provide comments and practical suggestions on issues which may arise during actual operation, maintenance and repair of the equipment and systems.
.4 Attends commissioning meetings periodically, depending on issues being discussed.
.5 Identifies the appropriate staff which must receive the O & M training.

1.09 COMMISSIONING MEETINGS

.1 General briefing on commissioning will be conducted at first project construction meeting at commencement of work.
.1 Issues discussed will include scope and extent of commissioning and clarify responsibilities of commissioning team members.
.2 All team members must attend, including subcontractors of equipment and systems to be commissioned.

.2 Include commissioning as one agenda item at each construction meeting held and chaired by Contractor during construction. Give subject due consideration for each material and equipment supplied and for all matters of Work.

.3 Whenever possible meetings will be held immediately following the construction meetings.

.4 Meeting will be chaired by Contractor, who will record and distribute minutes.

.5 Confirm all subcontractors and relevant manufacturer representatives are present at meetings as deemed required.

1.10 COMMISSIONING SCHEDULE

.1 Address commissioning activities within the construction work schedule. Clearly identify allocated time period for commissioning and training activities.

.2 Develop commissioning schedule in conjunction with Commissioning Agent. Indicate allocated time period and anticipated dates for:
.1 Submission of commissioning documentation, including O&M Manuals.
.2 Equipment and system start-up and performance verification, making them ready to be commissioned.
.3 Allocated period to commission designated building components and systems.
.4 Training period.
.5 Work during Warranty period.

.3 Submit schedule to Departmental Representative for review.

1.11 TRAINING

.1 Commence process of familiarizing Tenant and O&M personnel in the early stages of work on purpose and operation of various equipment and systems. Continue process throughout the entire construction duration.
  .1 Provide informal briefings during occasional site visits, at planned commissioning meetings and during the final commissioning site activities.

.2 Conduct formal demonstration and training sessions only after all identified systems have been commissioned by Commissioning Agent and Departmental Representative has given approval to proceed with the training process.

.3 Provide training and demonstration on all new equipment, sub-systems, systems and integrated systems.

.4 Carry out training in accordance with requirements of section 01 79 00.

.5 Submit written agenda of training session(s) four (4) weeks beforehand for review by Commissioning Agent and Departmental Representative.

.6 Coordinate content with Commissioning Agent. Design Consultant will provide introductory presentation giving general outline of each system design and intended function.

.7 Submit training manuals for review two (2) weeks prior to actual training.

.8 Keep required tools and O&M Manual on site for training and system demonstration.

.9 As a minimum, the training sessions to cover the following information:
  .1 Introduction.
  .2 Description of the system with factory personnel being involved at appropriate times.
  .3 Instructions on start-up procedures including seasonal procedures, system check-lists and emergency procedures.
  .4 Operational procedures, including occupancy considerations, seasonal change-over, manual and automatic operations and emergency modes.
  .5 Instruction on system shutdowns, including checklists.
  .6 Instructions on all aspects of system maintenance, including routine servicing, lubrication, overhaul and

factory servicing.
.7 Information concerning the scope of warranties and their use.
.8 A description of spare parts in stock and their service.
.9 A description of normal tools required for servicing the systems/equipment.

.10 Submit typewritten record of training sessions given and list of attendees. Use forms of format approved by Departmental Representative.

1.12 COMMISSIONING DOCUMENTATION

.1 Submit the following documentation for use during commissioning and for incorporation thereafter into a Building Management Manual (BMM):
.1 Operations and Maintenance Manuals, Project Record Documents and other data as specified in Section 01 78 00 - Closeout Submittals. Data to include:
.1 Equipment Product Information (PI Data) complete with:
.1 Nameplate info,
.2 Installation instructions,
.3 Operating procedures and
.4 Maintenance guidelines.
.2 Reviewed shop drawings,
.3 As-built record drawings and Specifications.
.2 Completed Installation/Start-up Checklist (Pre-functional) sheets used.
.3 Performance Verifications checks and tests procedures and completed report sheets used.
.4 Copy of any static and dynamic test and reports conducted.
.5 TAB report and other reports as specified in various trade sections.

.2 Above documentation is required by Commissioning Agent to commission Facility. Submit data minimum three (3) weeks before commencement of commissioning.

.3 Documentation to include detailed information and number of copies as specified for maintenance manuals of Section 01 78 00 - Closeout Submittals.

.4 Commissioning Agent and Design Consultant will compile above documentation and produce a BMM manuals for operation/maintenance staff and tenant use.

END OF SECTION

1 GENERAL

1.01 DESCRIPTION

.1 The purpose of this section is to specify mechanical contractor (MC) responsibilities in the commissioning process.

.2 The systems to be commissioned are listed in Section 01 91 13.

.3 Commissioning requires the participation of the MC to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Division 01. The MC must be familiar with all parts of Division 01 and the commissioning plan (01 91 31) and execute all commissioning responsibilities assigned to them in the Contract Documents.

1.02 RESPONSIBILITIES

.1 Mechanical, Controls and TAB contractors: The commissioning responsibilities applicable to each of the mechanical, controls and TAB contractors are as follows (all references apply to commissioned equipment only):

- .1 Include and itemize the cost of commissioning in the contract price.
- .2 In each purchase order or subcontract written, include requirements for submittal data, commissioning documentation, O&M data and training.
- .3 Attend a commissioning scoping meeting and other meetings necessary to facilitate the Cx process.
- .4 Contractors shall provide the CA with normal cut sheets and shop drawing submittals of commissioned equipment.
- .5 Develop prefunctional testing procedures and functional performance testing procedures as outlined in 01 91 35 and 01 91 36. In addition, submit the start-up and checkout materials, shipped with equipment to the CA.
- .6 Provide functional performance and equipment start-up sheets to the CA.
  - .1 Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians

shall be submitted to the Commissioning Agent.

.2 The Commissioning Agent may request further documentation necessary for the commissioning process.

.3 This data request may be made prior to normal submittals.

.7 Provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, to the CA for review and approval.

.8 Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

.9 Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the prefunctional checklists for all commissioned equipment. Submit to CA for review and approval prior to startup. Refer to Section 01 91 13 for further details on start-up plan preparation.

.10 During the startup and initial checkout process, execute the mechanical-related portions of the prefunctional checklists for all commissioned equipment.

.11 Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.

.12 Address current A/E punch list items before functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air or water related systems.

.13 Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

.14 Provide skilled technicians to perform functional performance testing for the equipment listed in sections 01 91 34 and 01 91 13. Assist the CA in interpreting the monitoring data, as necessary.

.15 Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, OR and A/E and retest the equipment.

.16 Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

.17 During construction, maintain as-built red-line drawings for all drawings and final CAD as-builts for contractor-generated coordination drawings. Update after completion of commissioning (excluding deferred testing).

.18 Provide training of the facility's operating staff using

expert qualified personnel, as specified.

.19 Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

.20 Warranty Period:

.1 Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings.

.2 Mechanical contractor: The responsibilities of the HVAC mechanical contractor, during construction and acceptance phases in addition to those listed in 1.2.1 are:

.1 Provide startup for all HVAC equipment.

.2 Assist and cooperate with the TAB contractor and CA by:

.1 Putting all HVAC equipment and systems into operation and continuing the operation during each working day of TAB and commissioning, as required.

.2 Including cost of sheaves and belts that may be required by TAB.

.3 Providing test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing. Provide a tight plug.

.4 Providing temperature and pressure taps for TAB and commissioning testing.

.3 Install a P/T plug at each water sensor which is an input point to the control system.

.4 List and clearly identify on the as-built drawings the locations of all air-flow stations.

.5 Prepare a preliminary schedule for pipe and duct system testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the CA. Update the schedule as appropriate.

.6 Notify the OR and CA depending on protocol, when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and TAB will occur. Be responsible to notify the OR or CA, ahead of time, when commissioning activities not yet performed or not yet scheduled will delay construction. Be proactive in seeing that commissioning processes are executed and that the CA has the scheduling information needed to efficiently execute the commissioning process.

.3 Controls contractor: The commissioning responsibilities of the controls contractor, during construction and acceptance phases in addition to those listed in 1.2.1 are:

.1 Sequences of Operation Submittals. The Controls contractor’s submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment. They shall include:

.1 An overview narrative of the system (1 or 2

paragraphs) generally describing its purpose, components and function.

.2 All interactions and interlocks with other systems.

.3 Detailed delineation of control between any packaged controls and the building automation system, listing what points the BAS monitors only and what BAS points are control points and are adjustable.

.4 Written sequences of control for packaged controlled equipment. (Equipment manufacturers' stock sequences may be included, but might

.5 Start-up sequences.

.6 Warm-up mode sequences.

.7 Normal operating mode sequences.

.8 Unoccupied mode sequences.

.9 Shutdown sequences.

.10 Capacity control sequences and equipment staging.

.11 Temperature and pressure control: setbacks, setups, resets, etc.

.12 Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, staging, optimization, demand limiting, etc.

.13 Effects of power or equipment failure with all standby component functions.

.14 Sequences for all alarms and emergency shut downs.

.15 Seasonal operational differences and recommendations.

.16 Initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.

.17 Schedules, if known.

.18 To facilitate referencing in testing procedures, all sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections, unless the sections are numbered.

.19 Prepare and submit functional performance test forms.

.2 Control Drawings Submittal

.1 The control drawings shall have a key to all abbreviations.

.2 The control drawings shall contain graphic schematic depictions of the systems and each component.

.3 The schematics will include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.

.4 Provide a full points list with at least the following

included for each point:
.1 Controlled system
.2 Point abbreviation
.3 Point description
.4 Display unit
.5 Control point or setpoint (Yes/No
.6 Monitoring point (Yes/No)
.7 Intermediate point (Yes/No)
.8 Calculated point (Yes/No)

Key:
Point Description: DB temp, airflow, etc.
Control or Setpoint: Point that controls equipment and can have its setpoint changed (OSA, SAT, etc.)
Intermediate Point: Point whose value is used to make a calculation which then controls equipment (space temperatures that are averaged to a virtual point to control reset).
Monitoring Point: Point that does not control or contribute to the control of equipment, but is used for operation, maintenance, or performance verification.
Calculated Point: "Virtual" point generated from calculations of other point values.
The Controls Contractor shall keep the CA informed of all changes to this list during programming and setup.

.5 An updated as-built version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.

.6 Assist and cooperate with the TAB contractor in the following manner:
.1 Meet with the TAB contractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).
.2 For a given area, have all required prefunctional checklists, calibrations, startup and selected functional tests of the system completed and approved by the CA prior to TAB.
.3 Provide a qualified technician to operate the controls to assist the TAB contractor in performing TAB, or provide sufficient training for TAB to operate the system without assistance.

.7 Assist and cooperate with the CA in the following manner:
  .1 Using a skilled technician who is familiar with this building, execute the functional testing of the controls system as specified for the controls contractor in Section 01 91 34 and 01 91 38. Assist in the functional testing of all equipment specified in Section 01 91 34 and 01 91 38. Provide two-way radios during the testing.
  .2 Execute all control system trend logs specified in Sections 01 91 34, 01 91 38 and on the drawings.

.8 The controls contractor shall prepare a written plan indicating in a step-by-step manner, the procedures that will be followed to test, checkout and adjust the control system prior to functional performance testing, according to the process in Section 01 91 13. At minimum, the plan shall include for each type of equipment controlled by the automatic controls:
  .1 System name.
  .2 List of devices.
  .3 Step-by-step procedures for testing each controller after installation, including:
    .1 Process of verifying proper hardware and wiring installation.
    .2 Process of downloading programs to local controllers and verifying that they are addressed correctly.
    .3 Process of performing operational checks of each controlled component.
    .4 Plan and process for calibrating valve and damper actuators and all sensors.
    .5 A description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
  .4 A copy of the log and field checkout sheets that will document the process. This log must include a place for initial and final read values during calibration of each point and clearly indicate when a sensor or controller has “passed” and is operating within the contract parameters.
  .5 A description of the instrumentation required for testing.
  .6 Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work.
  .7 Coordinate with the CA and TAB contractor for this determination.

.9 Provide a signed and dated certification to the CA and OR upon completion of the checkout of each controlled device, equipment and system prior to functional testing for each piece of equipment or system, that all system programming is complete as to all respects of the Contract Documents, except functional testing requirements.

.10 Beyond the control points necessary to execute all documented control sequences, provide monitoring, control and virtual points as specified on the drawings. List and clearly identify on the as-built duct and piping drawings the locations of all static and differential pressure sensors (air, water and building pressure).

.4 TAB Contractor: The duties of the TAB contractor, in addition to those listed in 1.2.1 are:

.1 Six (6) weeks prior to starting TAB, submit to the GC the qualifications of the site technician for the project, including the name of the contractors and facility managers of recent projects the technician was lead on. The Owner will approve the site technician's qualifications for this project.

.2 Submit the outline of the TAB plan and approach for each system and component to the CA, GC and the controls contractor six weeks prior to starting the TAB. This plan will be developed after the TAB has some familiarity with the control system.

.3 The submitted plan will include:

.1 Certification that the TAB contractor has reviewed the construction documents and the systems with the design engineers and contractors to sufficiently understand the design intent for each system.

.2 An explanation of the intended use of the building control system. The controls contractor will comment on feasibility of the plan.

.3 All field checkout sheets and logs to be used that list each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

.4 Discussion of what notations and markings will be made on the duct and piping drawings during the process.

.5 Final test report forms to be used.

.6 Detailed step-by-step procedures for TAB work for each system and issue: terminal flow calibration (for each terminal type), diffuser proportioning, branch/submain proportioning, total flow calculations, rechecking, diversity issues, expected problems and solutions, etc. Criteria for using air flow straighteners or

relocating flow stations and sensors will be discussed. Provide the analogous explanations for the water side.

.7 List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.

.8 Details of how total flow will be determined (Air: sum of terminal flows via BAS calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations. Water: pump curves, circuit setter, flow station, ultrasonic, etc.).

.9 The identification and types of measurement instruments to be used and their most recent calibration date.

.10 Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and provide methods to verify this.

.11 Confirmation that TAB understands the outside air ventilation criteria under all conditions.

.12 Details of whether and how minimum outside air cfm will be verified and set, and for what level (total building, zone, etc.).

.13 Details of how building static and exhaust fan / relief damper capacity will be checked.

.14 Proposed selection points for sound measurements and sound measurement methods.

.15 Details of methods for making any specified coil or other system capacity measurements.

.16 Details of any TAB work to be done in phases or of areas to be built later.

.17 Details regarding specified deferred or seasonal TAB work.

.18 Details of any specified false loading of systems to complete TAB work.

.19 Details of all exhaust fan balancing and capacity verifications, including any required room pressure differentials.

.20 Details of any required interstitial cavity differential pressure measurements and calculations.

.21 Plan for hand-written field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).

.22 Plan for formal progress reports (scope and frequency).

.23 Plan for formal deficiency reports (scope, frequency and distribution).

.4 A running log of events and issues shall be kept by the TAB field technicians. Submit hand-written reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests to the CA and GC at least twice a week.

.5 Communicate in writing to the controls contractor all setpoint and parameter changes made or problems and discrepancies identified during TAB which affect the control system setup and operation.

.6 Provide a draft TAB report within two weeks of completion. A copy will be provided to the CA. The report will contain a full explanation of the methodology, assumptions and the results in a clear format with designations of all uncommon abbreviations and column headings. The report should follow the latest and most rigorous reporting recommendations by AABC, NEBB or ASHRAE Standard 111.

.7 Provide the CA with any requested data, gathered, but not shown on the draft reports.

.8 Provide a final TAB report for the CA with details, as in the draft.

.9 Conduct functional performance tests and checks on the original TAB as specified for TAB in Section 01 91 34.

1.03 RELATED WORK

.1 Refer to Section 01 91 34, Part 1.4 for a listing of all sections where commissioning requirements are found.

.2 Refer to Section 01 91 13 Part 1.7 for systems to be commissioned and section 01 91 13 Part 1.6 and 01 91 34 for functional testing requirements.

.3 Refer to Section 25 08 20 for requirements for EMCS commissioning.

2 PRODUCTS

2.01 TEST EQUIPMENT

.1 MC shall provide all test equipment necessary to fulfill the testing requirements of this Division.

.2 Refer to Section 01 91 13 Part 2.1 for additional requirements.

3 EXECUTION

3.01 SUBMITTALS

.1 MC shall provide submittal documentation relative to

commissioning as required in this Section Part 1 and Section 01 91 13.

3.02 START-UP

.1 The HVAC mechanical and controls contractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in 01 91 13. MC has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning agent or Owner.

.2 Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or sub-systems at the discretion of the CA and GC. Beginning system testing before full completion, does not relieve the Contractor from fully completing the system, including all prefunctional checklists as soon as possible.

3.03 TAB

.1 Refer to the TAB responsibilities above.

3.04 FUNCTIONAL PERFORMANCE TEST

.1 Refer to Section 01 91 13 Part 1.4 for a list of systems to be commissioned and to Part 3.6 for a description of the process and to Section 01 91 34 for specific details on the required functional performance tests.

3.05 TESTING DOCUMENTATION, NON-CONFORMANCE AND APPROVALS

.1 Refer to Section 01 91 13 Part 3.4 for specific details on non-conformance issues relating to prefunctional checklists and tests.

.2 Refer to Section 01 91 13 Part 3.7 for issues relating to functional performance tests.

3.06 OPERATION AND MAINTENANCE (O&M) MANUALS

.1 The following O&M manual requirements do not replace O&M manual documentation requirements elsewhere in these specifications.

.2 MC shall compile and prepare documentation for all equipment and systems covered on the drawings and deliver this documentation to the GC for inclusion in the O&M manuals, according to this section and the drawings, prior to the training of owner

personnel.

.3 The CA shall receive a copy of the O&M manuals for review.

.4 Special Control System O&M Manual Requirements. In addition to documentation that may be specified elsewhere, the controls contractor shall compile and organize at minimum the following data on the control system in labeled 3-ring binders with indexed tabs and on a DVD.

.1 Three copies of the controls training manuals in a separate manual from the O&M manuals.

.2 Operation and Maintenance Manuals containing:

.1 Specific instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. These instructions shall be step-by-step. Indexes and clear tables of contents shall be included. The detailed technical manual for programming and customizing control loops and algorithms shall be included.

.2 Full as-built set of control drawings (refer to Submittal section above for details).

.3 Full as-built sequence of operations for each piece of equipment.

.4 Full points list. In addition to the updated points list required in the original submittals (Part 1 of this section), a listing of all rooms shall be provided with the following information for each room:

.1 Floor
.2 Room number
.3 Room name
.4 Air handler unit ID
.5 Reference drawing number
.6 Air terminal unit tag ID
.7 Heating and/or cooling valve tag ID
.8 Minimum cfm
.9 Maximum cfm

.5 Full print out of all schedules and set points after testing and acceptance of the system.

.6 Full as-built print out of software program.

.7 Electronic copy on disk of the entire program for this facility.

.8 Marking of all system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

.9 Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.

.10 Control equipment component submittals, parts lists, etc.

.11 Warranty requirements.
.12 Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).

.3 Organize the manual and subdivide with permanently labeled tabs for each of the following data in the given order:
.1 Sequences of operation
.2 Control drawings
.3 Points lists
.4 Controller / module data
.5 Thermostats and timers
.6 Sensors and DP switches
.7 Valves and valve actuators
.8 Dampers and damper actuators
.9 Program setups (software program printouts)

.4 Field checkout sheets and trend logs should be provided to the CA for inclusion in the Commissioning Record Book.

.5 Special TAB Documentation Requirements: The TAB will compile and submit the following with other documentation that may be specified elsewhere in the Specifications.
.1 Final report containing an explanation of the methodology, assumptions, test conditions and the results in a clear format with designations of all uncommon abbreviations and column headings.
.2 The TAB shall mark on the drawings where all traverse and other critical measurements were taken and cross reference the location in the TAB report.

.6 Review and Approvals. Review of the commissioning related sections of the O&M manuals shall be made by the A/E and by the CA. Refer to Section 01 91 13, Part 3.8 for details.

3.07 TRAINING OF OWNER PERSONNEL

.1 The GC shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed. Refer to Section 01 91 13 for additional details.

.2 Mechanical contractor: The mechanical contractor shall have the following training responsibilities:
.1 Provide the CA with a training plan two weeks before the planned training according to the outline described in Section 01 91 13, Part 3.9.
.2 Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, air handling units, VAV terminal units, controls, hot water heaters, fan coils and VRF heat pumps, etc.
.3 Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment,

which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.

.4 During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.

.5 The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.

.6 The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

.7 The training sessions shall follow the outline in the Table of Contents of the Operation and Maintenance Manual and illustrate whenever possible the use of the O&M manuals for reference.

.8 Training to include:

.1 Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.

.2 A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.

.3 Discussion of relevant health and safety issues and concerns.

.4 Discussion of warranties and guarantees.

.5 Common troubleshooting problems and solutions.

.6 Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.

.7 Discussion of any peculiarities of equipment installation or operation.

.8 The format and training agenda in The HVAC Commissioning Process, ASHRAE Guideline 1-1989R, 1996 is recommended.

.9 Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventative maintenance

for all pieces of equipment.

.10 The mechanical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system.

.11 Training shall occur after functional testing is complete, unless approved otherwise by the Project Manager.

.12 Duration of Training. The mechanical contractor shall provide training on each piece of equipment as specified.

.3 Controls contractor: The controls contractor shall have the following training responsibilities:

.1 Provide the CA with a training plan four weeks before the planned training according to the outline described in Section 01 91 13, Part 3.9.

.2 The controls contractor shall provide designated Owner personnel training on the control system in this facility as required by the project specifications.

.3 Training manuals. The standard operating manual for the system and any special training manuals will be provided for each trainee, with three extra copies left for the O&M manuals. In addition, copies of the system technical manual will be demonstrated during training and three copies submitted with the O&M manuals. Manuals shall include detailed description of the subject matter for each session. The manuals will cover all control sequences and have a definitions section that fully describes all relevant words used in the manuals and in all software displays. Manuals will be approved by the CA. Copies of audiovisuals shall be delivered to the Owner.

.4 The trainings will be tailored to the needs and skill-level of the trainees.

.5 The trainers will be knowledgeable on the system and its use in buildings. For the on-site sessions, the most qualified trainer(s) will be used. The Owner shall approve the instructor prior to scheduling the training.

.6 During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.

.7 The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

3.08 DEFERRED TESTING

.1 Refer to Section 01 91 13, Part 3.5 for requirements of deferred testing.

3.09 WRITTEN WORK PRODUCTS

.1 Written work products of Contractors will consist of the start-up and initial checkout plan described in Section 01 91 13 and the filled out start-up, initial checkout and prefunctional checklists.

END OF SECTION

1 GENERAL

1.01 DESCRIPTION

.1 The purpose of this section is to specify responsibilities of the Electrical contractor (EC) in the commissioning process. Other electrical system testing is required under the direction of the OR.

.2 The list of commissioned equipment and systems is found in Section 01 91 13.

.3 Commissioning requires the participation of the EC to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Division 01. The EC shall be familiar with all parts of Division 01 and the commissioning plan and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.02 RESPONSIBILITIES

.1 Electrical contractors: The commissioning responsibilities applicable to the electrical contractor are as follows (all references apply to commissioned equipment only):

.1 Construction and Acceptance Phases:

.1 Include the cost of commissioning in the contract price.

.2 In each purchase order or subcontract written, include requirements for submittal data, O&M data and training.

.3 Attend a commissioning scoping meeting and other necessary meetings to facilitate the Cx process.

.4 Contractors shall provide normal cut sheets and shop drawing submittals to the CA of commissioned equipment.

.5 Provide functional performance and equipment start-up sheets to the CA.

.1 Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, fan and pump curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent.

.2 The Commissioning Agent may request further documentation necessary for the commissioning process.
.3 This data request may be made prior to normal submittals.

.6 Provide a copy of the O&M manuals submittals of commissioned equipment, through normal channels, to the CA for review and approval.
.7 Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
.8 Provide specific functional performance test procedures specified in Section 01 91 38. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
.9 Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the prefunctional checklists. Submit manufacturer's detailed start-up procedures and the full start-up plan and procedures and other requested equipment documentation to CA for review.
.10 During the startup and initial checkout process, execute and document the electrical-related portions of the prefunctional checklists for all commissioned equipment.
.11 Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.
.12 Address current A/E punch list items before functional testing.
.13 Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
.14 Perform functional performance testing, witnessed by the CA, for equipment specified in Sections 01 91 38 and 01 91 13. Assist the CA in interpreting the monitoring data, as necessary.
.15 Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, OR and A/E and retest the equipment.
.16 Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
.17 During construction, maintain as-built red-line drawings for all drawings and final CAD as-builts for

contractor-generated coordination drawings. Update after completion of commissioning (excluding deferred testing). Prepare red-line as-built drawings for all drawings and final as-builts for contractor-generated coordination drawings.

.18 Provide training of the Owner's operating personnel as specified.

.19 Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

.2 Warranty Period

.1 Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified.

.2 Electrical Designer/Engineer

.1 Refer to Section 01 91 13 for the responsibilities of the Electrical Designer/Engineer.

1.03 RELATED WORK

.1 Refer to Sections 01 91 13 for a listing of all sections where commissioning requirements are found.

.2 Refer to Section 01 91 13 for systems to be commissioned and section 01 91 13 and 01 91 38 for functional testing requirements.

2 PRODUCTS

2.01 TEST EQUIPMENT

.1 The EC shall provide all test equipment necessary to fulfill the testing requirements of this Division.

.2 Refer to Section 01 91 13 Part 2.1 for additional electrical requirements.

3 EXECUTION

3.01 SUBMITTALS

.1 The EC shall provide submittal documentation relative to commissioning to the CA as requested by the CA. Refer to Section 01 91 13 for additional electrical requirements.

3.02 START-UP

.1 The electrical contractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this

section and in 01 91 13. The EC has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning agent or Owner.

.2 Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems, or sub-systems at the discretion of the CA and OR. Beginning system testing before full completion, does not relieve the Contractor from fully completing the system, including all prefunctional checklists as soon as possible.

3.03 FUNCTIONAL PERFORMANCE TEST

.1. Refer to Section 01 91 13 for a list of systems to be commissioned and a description of the process and to Section 01 91 38 for specific details on the required functional performance tests.

3.04 TESTING DOCUMENTATION, NON-CONFORMANCE AND APPROVALS

.1 Refer to Section 01 91 13 for specific details on non-conformance issues relating to pre-functional checklists and tests.

.2 Refer to Section 01 91 13 for issues relating to functional performance tests.

3.05 OPERATIONS AND MAINTENANCE (O&M) MANUALS

.1 The EC shall compile and prepare documentation for all equipment and systems covered on the drawings and deliver to the GC for inclusion in the O&M manuals, according to the drawings.

.2 The CA shall receive a copy of the O&M manuals for review.

3.06 TRAINING OF OWNER PERSONNEL

.1 The GC shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed. Refer to Section 01 91 13 for additional details.

.2 The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment. Refer to Section 01 91 13 for additional details.

.3 Electrical contractor: The electrical contractor shall provide training as specified and shall provide documentation to the CA describing the training when completed. The electrical

contractor shall have the following training responsibilities:
.1 Provide designated Owner personnel with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of commissioned electrical equipment or system.
.2 Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and maintenance of all pieces of equipment.
.3 The electrical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system.
.4 Training shall occur after functional testing is complete, unless approved otherwise by the Owner’s Representative.

.4 Duration of Training: The electrical contractor shall provide training on each piece of equipment. Training is expected to take no more than one day. Cover the lighting controls and power distribution.

END OF SECTION

1 GENERAL

1.01 PURPOSE OF THE COMMISSIONING PLAN

.1 The purpose of the construction phase commissioning plan is to:
  .1 Provide direction for the commissioning process during construction, particularly providing resolution for issues and providing details that cannot be, or were not, fully developed during design, such as scheduling, participation of various parties of this particular project, actual lines of reporting and approvals, coordination, etc.
  .2 This plan does not provide a detailed explanation of required testing procedures. The detailed testing requirements and procedures are found in the Specifications. Additionally, this plan does not provide extensive narrative on all commissioning concepts, as may be provided in other commissioning guides.

1.02 COMMISSIONED SYSTEMS

.1 See Section 01 91 13 for list of systems that will be commissioned in this project. All general references to equipment in this document refer only to equipment that is to be commissioned.

1.03 CONSTRUCTION/CX TEAM DATA (PRIMARY PARTIES)

Team Member	**Co. & Contact Names**	**Voice, office, cell, fax, email, address**
Owner Project Leader Project Manager (PM)	TBD	TBD
Property Manager	TBD	TBD
General Contractor Mechanical Contractor	TBD	TBD
Commissioning Authority	TBD	TBD
Architect	TBD	TBD
Mechanical Designer/Eng.	TBD	TBD
Electrical Designer/Eng.	TBD	TBD
Mechanical Contractor HVAC Site Superintendent	TBD	TBD
Piping Contractor	TBD	TBD

Team Member	**Co. & Contact Names**	**Voice, office, cell, fax, email, address**
Sheet Metal Contractor	TBD	TBD
Electrical Contractor	TBD	TBD
Site Supervisor	TBD	TBD
TAB Contractor	TBD	TBD
Controls Contractor	TBD	TBD

1.04 COMMISSIONING SCOPING MEETING

.1 Conduct meetings as described in 01 91 13.

1.05 SITE OBSERVATION

.1 The CA and the Design Consultant will make periodic visits to the site, as necessary, to witness equipment and system installations.

1.06 MISCELLANEOUS MEETINGS

.1 The CA may review construction meeting minutes, change orders or Site instructions for the same purpose.

.2 Later during construction, necessary meetings between various commissioning team parties will be scheduled by the CA, through the GC, as required.

1.07 SUBMITTALS AND PROCEDURES

.1 The CA may review submittals for commissioning requirements.

1.08 INSTALLATION CHECKLISTS, TESTS AND STARTUP

.1 Prefunctional checklists (PC) are important to ensure that the equipment and systems are hooked up and operational and that functional performance testing may proceed without unnecessary delays. Each piece of equipment receives full prefunctional checkout by the Contractor. No sampling strategies are used. In general, the prefunctional testing for a given system, must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

.2 Prefunctional checklists, installation /start-up checks are as described in 01 91 13.

.3 Prefunctional checklists to consist of startup and verification tests, plus any additional tests described in the attached forms or technical specification sections.

.4 Prefunctional tests to include those recommended by the equipment manufacturer, or in the absence of specific recommendations by the manufacturer as agreed by the Contractor and the CA.

.1 Document prefunctional tests in writing by the installing technician. The CA will not witness much of the prefunctional checklisting, except for testing of larger or more critical pieces of equipment and some spot-checking.

.2 Submit the prefunctional checklists to the CA for review and inclusion in the commissioning binder.

.3 Start-up plan:

.1 Submit to the CA manufacturer installation, startup and checkout data, including actual field checkout sheets used by the field technicians from the contractor.

.2 Execution of Checklists and Startup:

.1 Four (4) weeks prior to startup, the Subs and vendors schedule startup and initial checkout with the GC and CA. The startup and initial checkout are directed and executed by the Sub or vendor. The CA, and GC if necessary, observe, the procedures. For components of equipment, (e.g., radiant panels, fans, heat pumps, etc.), the CA observes a sampling of the prefunctional and start-up procedures. To document the process of startup and checkout, the site technician performing the line item task initials and dates each paragraph of procedures in the "Startup Plan" and checks off items on the prefunctional and manufacturer field checkout sheets, as they are completed. Only individuals having direct knowledge of a line item being completed shall check or initial the forms. The Subs and vendors execute the checklists and tests and submit a signed copy of the completed start-up and prefunctional tests and checklists to the CA. Further details are found in the Specifications Section 01 91 13. The CA may review prefunctional checklists in progress, as necessary.

.3 Deficiencies and Non-Conformance:

.1 Clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully at the bottom of the procedures form or on an attached sheet. The

procedures form and deficiencies are provided to the CA within two days of test completion.

.2 The Subs and vendors must correct and retest deficiencies or uncompleted items, involving the GC and others as necessary. The installing Subs or vendors correct all areas that are deficient or incomplete according to the checklists and tests.

.4 TAB:

.1 Submit the outline of the TAB plan and approach to the CA and the controls contractor eight weeks prior to starting the TAB. Included in the approach, is an explanation of the intended use of the building control system. The CA reviews the plan and approach for understanding and coordination issues and may comment, but does not "approve." The controls contractor reviews the feasibility of using the building control system for assistance in the TAB work.

.2 Functional performance testing does not begin until the TAB work is complete. A checklist form for reviewing the TAB plan is provided as one of the prefunctional checklists.

.3 TAB work will not begin until the control system has been prefunctionally tested and selective functional tests have been performed and approved by the CA.

.5 Controls Checkout Plan:

.1 Develop and submit a written step-by-step plan to the CA which describes the process they intend to follow in checking out the control system and the forms on which they will document the process. The Contractor will also meet with the TAB subcontractor prior to the start of TAB and review the TAB plan to determine the capabilities of the control system for use in TAB. The Contractor shall also provide a technician qualified to operate the controls to assist the TAB subcontractor in performing TAB.

.2 All controls prefunctional checklists, calibrations, start-up and selected functional tests of the system must be completed and approved by the CA prior to TAB. Execute the tests and trend logs assigned to them and remain on site for assistance for mechanical system functional tests as specified in the same sections.

1.09 DEVELOPMENT OF PERFORMANCE VERIFICATION PROCEDURES

.1 Overview: Performance Verification (PV) testing, also referred to as functional testing, is the dynamic testing of systems (rather than just components) under full operation. Systems are tested under various modes, such as during low heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all of the control system's sequences of operation and components are verified to be responding as the sequences state. The commissioning agent shall witnesses functional test procedures, but the testing is performed by the installing contractor or vendor. Tests shall be documented and submitted to the CA by the Contractor.

.2 Functional testing to consist of all performance testing required for each piece of commissioned equipment described in this section or technical specification sections. A detailed description of the functional and prefunctional testing procedures and process is found in the Specifications, 01 91 13, Part 3.

.3 Functional testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone dataloggers. According to the Specifications, not all pieces of identical equipment receive in-depth testing. The CA reviews factory or required acceptance tests and determines what further testing may be required to comply with the Specifications. Redundancy is minimized.

1.10 EXECUTION OF PERFORMANCE VERIFICATION PROCEDURES

.1 Overview and Process: The GC must schedule functional tests through the affected Subs and notify the PM and CA. For any given system, prior to performing functional testing, the CA shall wait until the prefunctional checklist has been submitted with the necessary signatures, confirming that the system is ready for functional testing.

.1 The CA will witness and document the functional testing of all equipment and systems according to the Specifications and the Cx Plan. The Subs execute the tests. The control system is tested before it is used to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems and finally to interlocks and connections between systems. Refer to specification section 01 91 13 for additional process details.

.2 Deficiencies and Retesting: The CA documents the results of the test. Corrections of minor deficiencies identified are made during the tests at the discretion of the CA. The CA records the results of the test on the procedure or test form. Deficiencies or non-conformance issues are noted and reported to the CM. Subs correct deficiencies, notify the CA in writing certifying correction. The GC schedules retesting through the CM. Decisions regarding deficiencies and corrections are made at as low a level as possible, preferably between CA or GC and the Sub. For areas in dispute, final authority, besides the Owner's, resides with the A/E. The CA recommends acceptance of each test to the CM. The CM gives final approval on each test.

.3 The Owner's facilities operating staff are encouraged to attend and participate in the testing process. The CA will notify the CM, who will then notify the facility staff when the commissioning events will occur.

1.11 O&M MANUALS AND WARRANTIES

.1 Standard O&M Manuals: The CA reviews the O&M manuals, documentation and redline as-builts for systems that were commissioned to verify compliance with the Specifications. The CA recommends approval and acceptance of these sections of the O&M manuals to the CM. The CA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. Refer to Specifications 01 91 13 for further details.

.2 Commissioning Record: The CA will compile a commissioning binder that represents the commissioning activities and submit it to the owner for their record.

1.12 TRAINING AND ORIENTATION OF OWNER PERSONNEL

.1 Provide Owner training and orientation on equipment and systems in accordance with the project specifications and 01 91 13.

.2 Submit records of the training activity, initialed by the attendees, to the CA for inclusion in the Commissioning Binder.

1.13 WARRANTY PERIOD

.1 During the warranty period, seasonal testing and other deferred testing required is completed according to the Specifications. Correct deficiencies and have testing witnessed by facilities staff. The CA will return to the project approximately 10 months into the 12 month warranty period. During this visit(s) the CA

will review with facility staff the current building operation. The CA will identify areas that may come under warranty or under the original construction contract.

1.14 SCHEDULE

.1 The following sequential priorities must be followed:
- .1 Equipment is not "temporarily" started (for heating or cooling), until pre-start checklist items and all manufacturer's pre-start procedures are completed and moisture, dust and other environmental and building integrity issues have been addressed.
- .2 Functional testing is not begun until prefunctional and start-up and TAB is completed, for a given system (this does not preclude a phased approach).
- .3 The controls system and equipment it controls are not functionally tested until all points have been calibrated and pre-functional testing completed.
- .4 TAB is not performed until the controls system has been sufficiently functionally tested and approved by the CA for TAB work.
- .5 TAB is not performed until the envelope is completely enclosed and ceiling complete, unless the return are is ducted.

1.15 INITIAL COMMISSIONING SCHEDULE SUMMARY

Task / Activity	**Estimated Start Date**	**Estimated End Date**
Initial scoping meeting and final plan	TBD	
Submittals obtained and reviewed		
Begin construction site visits/inspections		
Prefunctional forms developed and distributed		
Startup and initial checkout plans		
Startup and initial checkout executed		
TAB: Water Air		
Functional performance tests		
O&M documentation review and verification		
Training and training verification		
Final commissioning report		

END OF SECTION

1 GENERAL

1.01 INCLUDED SYSTEMS AND EQUIPMENT

.1 The following is a list of the Mechanical system equipment and system test requirements included in this section:
.1 Unit/Forced Flow Heaters
.2 Heat Recovery Ventilator
.3 Fans & Motorized Dampers
.4 Testing, Adjusting and Balancing (TAB)
.5 Controls
.6 Pumps
.7 Ceiling Fans
.8 Hot Water Heaters
.9 Plumbing Fixtures
.10 Variable Refrigerant Volume Air Source Heat Pump and associated duct heater.

1.02 DESCRIPTION

.1 This section specifies the contractors responsibility to execute functional testing requirements for mechanical systems and equipment. The general functional testing process, requirements and test method definitions are described in Section 01 91 13. The test requirements for each piece of equipment or system shall contain the following:
.1 A list of the integral components being tested.
.2 Prefunctional checklists associated with the components.
.3 Functions and modes to be tested.
.4 Required conditions of the test for each mode.
.5 Special procedures.
.6 Required methods of testing.
.7 Required monitoring.
.8 Acceptance criteria.
.9 Sampling strategies allowed.

1.03 PREREQUISITES

.1 Provide the following check list, signed off, prior to functional testing of each system.
.1 __ All related equipment has been started up and start-up reports and prefunctional checklists submitted and approved ready for functional testing.
.2 __ All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final setpoints and schedules with debugging, loop tuning and sensor calibrations completed. Controls Contractor Signature or Verbal with date.
.3 __ Piping system flushing complete and required report

submitted to the CA.
.4 __ Test and Balance (TAB) complete.
.5 __ These functional test procedures reviewed and approved by installing contractor.
.6 __ Safeties and operating ranges verified.
.7 __ Test requirements and sequences of operation attached.
.8 __ Schedules and setpoints attached.
.9 __ False loading equipment, system and procedures ready.
.10 __ Sufficient clearance around equipment for servicing.
.11 __ Record of all values for pre-test setpoints changed to accommodate testing has been made and a check box provided to verify return to original values (control parameters, limits, delays, lockouts, schedules, etc.).
.12 __ Other miscellaneous checks of the prefunctional checklist and start-up reports completed successfully.

1.04 MONITORING

.1 All control system monitored points shall be trended by the controls contractor.

.2 Hard copies of monitored data must be in columnar format with time down the left column and at least 5 columns of point values on the same page.

.3 Graphical output will be required for all output.

2 PRODUCTS Not Applicable.

3 EXECUTION

3.01 HEAT RECOVERY VENTILATOR (HRV)

.1 Parties Responsible to Execute Functional Test
.1 Controls contractor: operate the controls to activate the equipment as needed.
.2 CA: to witness.

.2 Prerequisites: The applicable prerequisite checklist items listed in the beginning of this Section shall be submitted to the CA.

.3 Functional Performance Testing.
.1 Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned.
.2 Test damper interlocks and correct modulation in all modes.
.3 Heating, Cooling and heat recovery system operation. In addition to simulating the peak performance of these systems also set up trend monitoring to observe the output from these systems throughout the year.

.4 Sensor and actuator calibration checks: on SAT, MAT, OSAT, OSA & RA damper and valve positions, SF cfm reading with TAB, and other random checks (EMS readout against hand-held calibrated instrument or observation must be within specified tolerances).
.5 Check and document installed filter efficiencies.

.4 Required Monitoring
.1 All points listed below which are control system monitored points shall be trended by the controls contractor.

Point	Time Step (min.)	Minimum Time Period of Trend	Hard Copy? (Y/N)	ASCII File? (Y/N)
For HRV				
RAT	5	5 days incl. weekend	Y	Y
RAH	5	5 days incl. weekend	Y	Y
HC LAT	5	5 days incl. weekend	Y	Y
SAT	5	5 days incl. weekend	Y	Y
SAH	5	5 days incl. weekend	Y	Y
SF/RF speed	5	5 days incl. weekend	Y	Y
Damper Specification	5	5 days incl. weekend	Y	Y
OSAT	5	5 days incl. weekend	Y	Y
Indoor dry-bulb 8 zones (expected to be most problematic, 2 on each level)	5	5 days incl. weekend	Y	Y

3.02 FANS

.1 Parties Responsible to Execute Functional Test
.1 Controls contractor: operate the controls to activate the equipment, if BAS controlled.
.2 CA: to witness.

.2 Prerequisites: The applicable prerequisite checklist items listed in the beginning of this Section shall be submitted to the CA.

.3 Functions/Modes Required To Be Tested, Test Methods and Seasonal Test Requirements. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Division.
.1 Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned.
.2 Check all alarms and safeties and flow switch functions.

.4 Acceptance Criteria: For the conditions, sequences and modes tested, the fans, integral components and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

3.03 DOMESTIC HOT WATER HEATER

.1 Parties Responsible to Execute Function Test
.1 Controls contractor: to operate the controls as needed.
.2 CA: to witness.

.2 Prerequisites: The applicable prerequisite checklist items listed in the beginning of this Section shall be submitted to the CA.

.3 Functional Performance Testing:
.1 Test each sequence in the sequence of operations, and other significant modes and sequence not mentioned.
.2 Check all alarms and safeties.

3.04 TEST AND BALANCE WORK (TAB)

.1 Parties Responsible to Execute Functional Test
.1 Controls contractor: operate the controls to activate the equipment.
.2 CA: to witness.

.2 Prerequisites: The applicable prerequisite checklist items listed in the beginning of this Section shall be submitted to the CA.

.3 Purpose. The purpose of this test is to spot check the TAB work to verify that it was done in accordance with the contract documents and acceptable practice and that the TAB report is accurate.

.4 The following tests and checks will be conducted. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in this Division.

.5 A random sample of up to 20% the TAB report data shall be selected for verification (air velocity, air or water flow rate,

pressure differential, electrical or sound measurement, etc.). The original TAB contractor will execute the checks, witnessed by the commissioning authority. The TAB contractor will use the same test instruments as used in the original TAB work.
.1 A failure of more than 10% of the selected items of a given system shall result in the failure of acceptance of the system TAB report and the TAB contractor shall be responsible to rebalance the system, provide a new system TAB report and repeat random verifications of the new TAB report.
.2 The random testing will include the verification of minimum outdoor air intake flows at minimum, maximum and intermediate total airflow rates for all of the air handlers. Other selected data to be verified will be made known upon day of testing.

.6 Verify that final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked by the TAB Contractor.

.7 Verification that the water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity. This shall include a review of TAB methods, control setpoints established by TAB and a physical verification of at least one leg from the pump to the load having all balancing valves wide open.

3.05 BUILDING AUTOMATION SYSTEM (BAS)

.1 Parties Responsible to Execute Functional Test
.1 Controls contractor: operate the controls to activate the equipment.
.2 CA: to witness.

.2 Prerequisites: The applicable prerequisite checklist items listed in the beginning of this Section shall be submitted to the CA.

.3 Integral or stand-alone controls are functionally tested with the equipment they are attached to, including any interlocks with other equipment or systems and thus are not covered under the BAS testing requirements, except for any integrated functions or interlocks listed below.

.4 In addition to the controlled equipment testing, the following tests are required for the BAS, where features have been specified. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in the specifications.

	Function/Mode	Test Method Manual (demonstration), Monitoring, Either or Both
MISCELLANEOUS FUNCTIONS		
.1	All specified functions and features are set up, debugged and fully operable.	Verbal discussion of features
.2	Power failure and battery backup and power-up restart functions.	Demonstration
.3	Specified trending and graphing features demonstration.	See equipment trends
.4	Global commands features.	Demonstration
.5	Security and access codes.	Demonstration
.6	Occupant over-rides (manual, telephone, key, keypad, etc.)	Demonstration
.7	O&M schedules and alarms	Demonstration
.8	Scheduling features fully functional and setup, including holidays.	Observation in terminal screens or printouts
.9	Date and time setting in central computer and verify field panels read the same time	Demonstration
.10	Included features not specified to be setup are installed (list).	Demonstration
.11	Occupancy sensors and controls.	Demonstration
.12	Demonstrate functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad.	Demonstration of 100% of panels and 10% of ports
.13	All graphic screens and value readouts completed.	Demonstration
.14	Setpoint changing features and functions.	Done during equipment testing
.15	Communications to remote sites.	Demonstration
.16	Sensor calibrations.	Sampled during equipment tests
.17	Final as-builts or redlines (per spec) control drawings, final points list, program code, setpoints, schedules, warranties, etc. per specs, submitted for O&Ms.	Observation
.18	Verify that points that are monitored only, having no control function, are checked for proper reporting to BAS.	Observation
INTEGRATED TESTS		

	Function/Mode	Test Method Manual (demonstration), Monitoring, Either or Both
.19	Duty cycling.	Monitoring
.20	Sequential staging ON of equipment.	Either
.21	Optimum start-stop functions.	Monitoring
.22	All control strategies and sequences not tested during controlled equipment testing.	Either
.23	Other integrated tests specified in the contract documents.	

.5 Acceptance Criteria
.1 For the conditions, sequences and modes tested, the BAS, integral components and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

.6 Sampling Strategy for demonstrating performance of identical units
.1 Sample 10% of the field panels for procedure 9, and 10% of the local ports for procedure 12. If 10% fail, test another 10%. If 10% of those fail, test all remaining units at the contractor's expense.

3.06 FORCE FLOW/UNIT HEATERS

.1 Parties Responsible to Execute Functional Test
.1 Controls contractor: operate the controls as needed.
.2 CA: to witness.

.2 Prerequisites: The applicable prerequisite checklist items listed in the beginning of this Section shall be submitted to the CA.

.3 Functional Performance Testing:
.1 Record space temperatures.
.2 Confirm fan operation.

3.07 PUMPS

.1 Parties Responsible to Execute Functional Test
.1 Controls contractor: operate the controls as needed.
.2 Mechanical contractor or vendor: assist in testing sequences.
.3 CA: to witness.

.2 Prerequisites: The applicable prerequisite checklist items listed in the beginning of this Section shall be submitted to the CA.

.3 Functional Performance Testing:
.1 Test control through every cycle of operation.
.2 Provide trend logs of system flow and discharge pressure.

3.08 PLUMBING FIXTURES

.1 Parties Responsible to Execute Functional Test
.1 Mechanical contractor or vendor: assist in testing sequences.
.2 CA: to witness.

.2 Prerequisites: The applicable prerequisite checklist items listed in the beginning of this Section shall be submitted to the CA.

.3 Functional Performance Testing:
.1 Check water temperature and confirm flow.
.2 Confirm no cross contamination.

3.09 AIR SOURCE HEAT PUMP

.1 Parties responsible for executing functional test:
.1 Controls contractor.
.2 HVAC mechanical contractor
.3 CA: to witness

.2 Prerequisites: the applicable checklist items listed in the beginning of this section must be submitted to the CA.

.3 Functional Performance Testing:
.1 Test each sequence in the sequence of operations and other significant modes and sequences not mentioned.
.2 Required Monitoring: provide trend logs of system fluid temperatures and air temperatures.

END OF SECTION

1.01 GENERAL

.1 Submit blank forms for the prefunctional test to the CA.

.2 Contractor may use the included sample blank forms for developing equipment specific blank test forms. Note that sample forms are not included for every piece of equipment which is to be commissioned. These forms are included to indicate the level of detail required.

.3 Submit a customized blank prefunctional test forms for each system included for commissioning listed in the commissioning plan and commissioning specification section 01 91 13 and the drawings.

.4 Prefunctional testing performed on non-approved forms will not be accepted.

.5 Make necessary modifications to forms as noted by the CA.

END OF SECTION

1.01 GENERAL

.1 Submit final Functional Test Procedures forms to CA for approval.

.2 Contractor may use included sample forms for developing final procedures.

.3 Submit forms for each system intended to be commissioned as listed in commissioning plan and specification section 01 91 13.

.4 Submit blank forms well in advance of any scheduled test for review and approval.

.5 Make the necessary modifications to the blank forms as instructed by the CA.

1.02 FORMS

.1 The following forms are attached at the end of this Section:
- .1 Air Handling Units (AHU or HRV).
- .2 Domestic Hot Water Heater.
- .3 Air Source Heat Pump.

END OF SECTION

FT-_____ Air Handling Unit (AHU or HRV)_____

1. Prerequisite Checklist

a. __ All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final setpoints and schedules with debugging, loop tuning and sensor calibrations completed.

_____ _____
Controls Contractor Signature or Verbal Date

b. __ Vibration control completed.
c. __ Test and balance (TAB) completed and approved for the air systems.
d. __ All A/E punch list items for this equipment corrected.
e. __ These functional test procedures reviewed and approved by installing contractor.
f. __ Safeties and operating ranges reviewed.
g. __ Test requirements and sequences of operation attached.
h. __ Schedules and setpoints attached.
i. __ Have all energy savings control strategies, setpoints and schedules been incorporated that this equipment and control system are capable of? If not, list recommendations below.
j. __ Control Program Review. Review the software control program(s) for this equipment. Parameters, setpoints and logic sequences appear to follow the specified written sequences.

2. Sensor Calibration Checks. Check the sensors listed below for calibration and adequate location. This is a sampling check of calibrations done during prefunctional checklisting.

"In calibration" means making a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage or building automation system (BAS)) compared to the test instrument-measured value is within the tolerances specified in the prefunctional checklist requirements (_____). If not, install offset in BAS, calibrate or replace sensor. Use the same test instruments as used for the original calibration, if possible.

Notes:

Sensor & Location	Loc-ation OK[1]	**1st** Gage or BAS Value	Instr. Meas'd Value	**Final** Gage or BAS Value	Pass Y/N?

Sensor & Location	Loc-ation OK[1]	**1st** Gage or BAS Value	Instr. Meas'd Value	**Final** Gage or BAS Value	Pass Y/N?

[1]Sensor location is appropriate and away from causes of erratic operation.

3. Device Calibration Checks. The actuators or devices listed below checked for calibration. This is a spot check on a sample of the calibrations done during prefunctional checklisting and startup.

"In calibration" means observing a readout in the BAS and going to the actuator or controlled device and verifying that the BAS reading is correct. For items out of calibration or adjustment, fix now if easy, via an offset in the BAS, or a mechanical fix.

Device or Actuator & Location	**Procedure / State**	**1st** BAS Value	Site Observation	**Final** BAS Reading	Pass Y/N
OA damper position	1. Closed				
	.2 Full open				
EA damper position	1. Closed				
	2. Full open				

4. Verification of Misc. Prefunctional Checks.

Misc. site checks of the prefunctional checklist and startup reports completed successfully. Pass? Y / N _____

General Conditions of Test

_____
_____
_____

Notes:

5. Functional Testing Record

Seq. ID From Specs[1]	**Mode ID[2]**	**Test Procedure[3]** (including special conditions)	**Expected Response[4]**	**Pass Y/N**	**Note**
OCCUPIED	OA DAMPER OPENS				
OCCUPIED	FAN START				
UNOCCUPIED	FANS STOP				
UNOCCUPIED	DAMPERS CLOSE				
SAFETY	SF STOPS WHEN OA DAMPER CLOSES				

Record Foot Notes
[1]Sequences of operation specified in Contract Documents.
[2]Mode or function ID being tested from testing requirements section of the project Specifications.
[3]Step-by-step procedures for manual testing, trend logging or data-logger monitoring.
[4]Include tolerances for a passing condition.
[5]Record any permanently changed parameter values and submit to Owner.

END OF AIR HANDLING UNIT (AHU) TEST

Notes:

Project:_____

FT-_____ DOMESTIC HOT WATER HEATER

1. Participants

Party	Participation

Party filling out this form and witnessing testing

_____

Date of test _____

2. Prerequisite Checklist

a. __ All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final setpoints, schedules, debugging, loop tuning and sensor calibrations complete.

_____ _____
Controls Contractor Signature or Verbal Date

b. __ All A/E punch list items for this equipment corrected.
c. __ Safeties and operating ranges reviewed.
d. __ Test requirements and sequences of operation attached.
e. __ Schedules and setpoints attached.
f. __ Have all energy savings control strategies, setpoints and schedules been incorporated that this equipment and control system are capable of? If not, list recommendations below.
g. __ **BAS Program Review.** Review the BAS software control program(s) for this equipment. Parameters, setpoints and logic sequences appear to follow the specified written sequences.
h. __ Record of All Values for Current Setpoints (SP), Control Parameters, Limits, Delays, Lockouts, Schedules, Etc. Changed to Accommodate Testing:

Notes:

Parameter	Pre-Test Values	Returned to Pre-Test Values √

Parameter	Pre-Test Values	Returned to Pre-Test Values √

3. **Sensor Calibration Checks.** Check the sensors listed below for calibration and adequate location. This is a sampling check of calibrations done during prefunctional checklisting. Test the packaged controls and BAS readings.
NONE

4. **Device Calibration Checks.**
NONE

5. **Verification of Misc. Prefunctional Checks.**
Misc. site checks of the prefunctional checklist and startup reports completed successfully.
Pass? Y / N _____ __ Unit mounted securely.

6. **Functional Testing Record**

Proced. No. & Spec. Seq. ID[1]	Req ID No.[2]	Test Procedure[3] (including special conditions)	Expected and Actual Response[4] [Write ACTUAL response in brackets or circle]	Pass Y/N & Note #

Notes:

Record Foot Notes

[1]Sequences of operation specified in Contract Documents (attached).
[2]Mode or function ID being tested, per testing requirements section of the project Specifications.
[3]Step-by-step procedures for manual testing, trend logging or data-logger monitoring.
[4]Include tolerances for a passing condition.
[5]Record any permanently changed parameter values and submit to Owner.

END OF TEST

Notes:

Project:_____

FT-_____ AIR SOURCE HEAT PUMP

1. Participants

Party	Participation

Party filling out this form and witnessing testing

_____

Date of test _____

2. Prerequisite Checklist

a. __ All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final setpoints, schedules, debugging, loop tuning and sensor calibrations complete.

_____ _____
Controls Contractor Signature or Verbal Date

b. __ All A/E punch list items for this equipment corrected.
c. __ Safeties and operating ranges reviewed.
d. __ Test requirements and sequences of operation attached.
e. __ Schedules and setpoints attached.
f. __ Have all energy savings control strategies, setpoints and schedules been incorporated that this equipment and control system are capable of? If not, list recommendations below.
g. __ **BAS Program Review.** Review the BAS software control program(s) for this equipment. Parameters, setpoints and logic sequences appear to follow the specified written sequences.
h. __ Record of All Values for Current Setpoints (SP), Control Parameters, Limits, Delays, Lockouts, Schedules, Etc. Changed to Accommodate Testing:

Notes:

Parameter	Pre-Test Values	Returned to Pre-Test Values √

Parameter	Pre-Test Values	Returned to Pre-Test Values √

3. Sensor Calibration Checks. Check the sensors listed below for calibration and adequate location. This is a sampling check of calibrations done during prefunctional checklisting. Test the packaged controls and BAS readings.
NONE

4. Device Calibration Checks.
NONE

5. Verification of Misc. Prefunctional Checks.
Misc. site checks of the prefunctional checklist and startup reports completed successfully.
Pass? Y / N _____ __ Unit mounted securely.

6. Functional Testing Record

Proced. No. & Spec. Seq. ID[1]	Req ID No.[2]	Test Procedure[3] (including special conditions)	Expected and Actual Response[4] [Write ACTUAL response in brackets or circle]	Pass Y/N & Note #

Record Foot Notes

Notes:

[1]Sequences of operation specified in Contract Documents (attached).
[2]Mode or function ID being tested, per testing requirements section of the project Specifications.
[3]Step-by-step procedures for manual testing, trend logging or data-logger monitoring.
[4]Include tolerances for a passing condition.
[5]Record any permanently changed parameter values and submit to Owner.

END OF TEST

Notes:

1 GENERAL

1.01 INCLUDED SYSTEMS AND EQUIPMENT

.1 The following is a list of the equipment and system test requirements included in this section
- .1 Lighting controls
- .2 General Indoor Light Levels
- .3 Baseboard Heaters

1.02 DESCRIPTION

.1 This section specifies the functional testing requirements for electrical systems and equipment. Submit specific testing strategies from the general functional testing process, requirements and testing methods definitions are described in Section 01 91 13. The test requirements for each piece of equipment or system contain the following:
- .1 The contractors responsible to execute the tests, under the direction of the CA.
- .2 A list of the integral components being tested.
- .3 Pre-functional checklists associated with the components.
- .4 Functions and modes to be tested.
- .5 Required conditions of the test for each mode.
- .6 Special procedures.
- .7 Required methods of testing.
- .8 Required monitoring.
- .9 Acceptance criteria.
- .10 Sampling strategies allowed.

1.03 PREREQUISITES

.1 The following applicable generic prerequisite checklist items are required to be submitted to the CA prior to functional testing.
- .1 __ All related equipment has been started up and start-up reports and prefunctional checklists submitted and approved ready for functional testing:
- .2 __ All A/E punch list items for this equipment corrected.
- .3 __ These functional test procedures have been submitted and reviewed by CA.
- .4 __ Safeties and operating ranges reviewed by the CA.
- .5 __ Test requirements and sequences of operation attached.
- .6 __ Schedules and setpoints attached.
- .7 __ Sufficient clearance around equipment for servicing
- .8 __ Record of all values for pre-test setpoints changed to accommodate testing has been made and a check box provided to verify return to original values (control parameters, limits, delays, lockouts, schedules, etc.).

.9 __ Other miscellaneous checks of the prefunctional checklist and start-up reports completed successfully.

1.04 Monitoring

.1 Monitoring is a method of testing as a stand-alone method or to augment manual testing.

.2 All points listed in the required monitoring section of the test requirements which are control system monitored points shall be trended by the lighting controls contractor. At the CA's request, the lighting controls contractor shall trend up to 20% more points than listed at no extra charge.

.3 Hard copies of monitored data must be in columnar format with time down the left column and at least 4 columns of point values on the same page. Graphical output is a desirable option, if the system can produce it.

2 PRODUCTS Not applicable

3 EXECUTION

3.01 Lighting Controls

.1 Parties Responsible to Execute Functional Test
.1 Electrical contractor: assist in testing sequences
.2 CA: to witness.

.2 Prerequisites: The applicable prerequisite checklist items listed in the beginning of Section 01 91 38 shall be listed on each functional test form and checked off prior to functional testing.

.3 Functions/Modes Required To Be Tested and Test Methods
.1 The following testing requirements are an addition to and do not replace any testing requirements elsewhere in this Division.

Function / Mode	**Test Method Manual (demonstration), Monitoring, Either or Both**
MISCELLANEOUS FUNCTIONS	
.1 All specified functions and features are set up, debugged and fully operable.	Verbal discussion of features

Function / Mode	Test Method Manual (demonstration), Monitoring, Either or Both
.2 Power failure and battery backup and power-up restart functions.	Demonstration
.3 Verify override duration setting.	Demonstration

.4 Special Procedures (other equipment to test with, etc.; reference to function ID): None.

.5 Required Monitoring:
.1 None required, though monitoring can substitute for manual testing for all functions. See section 1.4 above.

.6 Acceptance Criteria (referenced by function or mode ID) 1-9 For the conditions, sequences and modes tested, integral components (All) and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

3.02 General Indoor Light Levels

.1 This is a performance test to verify that the lighting systems can provide fixed light levels equal to the specifications.
.1 Parties Responsible to Execute Functional Test
.2 Commissioning authority
.3 Contractor or A/E witness optional

.2 Integral Components or Related Equipment Being Tested: none.

.3 Prerequisites: none.

.4 Test Conditions: perform test at night, with lights on in adjacent rooms open to the tested space. Close doors from the tested space.

.5 Special Procedures:
.1 Space should be normally furnished and wall, floor and ceiling finishes complete.

.6 Required Monitoring: None.

.7 Acceptance Criteria
.1 Average light levels in the tested space at the workplace elevation must not be less than 10% below nor greater than 30% above the specified light level range for the space.

.8 Sampling Strategy

.1 At least 10% of all space zones and rooms shall be verified to be realizing proper light levels, chosen by the Owner.

.9 If 10% of the spaces in the first sample fail the functional performance tests, test another 10% of the group (the 2nd sample). If 10% of the spaces in the 2nd sample fail, test all remaining spaces, fully at the contractor's expense.

END OF SECTION

1.01 GENERAL

.1 Submit blank forms for the prefunctional test to the CA.

.2 Contractor may use the included sample blank forms for developing equipment specific blank test forms.

.3 Submit a customized blank prefunctional test forms for each system included for commissioning listed in the commissioning plan and commissioning specification sections 01 91 13 and the drawings.

.4 Prefunctional testing performed on non-approval forms shall not be accepted.

.5 Make necessary modifications to forms as noted by the CA.

1.02 FORMS

.1 The following forms are attached at the end of this section:
- .1 Power Distribution System Pre-functional Checklist.
- .2 Lighting and Lighting Control Pre-functional Checklist.
- .3 Baseboard heaters.

END OF SECTION

PC-___ POWER DISTRIBUTION SYSTEM

__ Entire Building

Associated checklists: _____

1. Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This prefunctional checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed.___ List attached.

_____	_____	_____	_____
Electrical Contractor	Date	General Contractor	Date

Prefunctional checklist items are to be completed as part of startup & initial checkout, preparatory to functional testing.

- This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.
- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = architect/engineer, All = all contractors, CA = commissioning agent, CC = controls contractor, EC = electrical contractor, GC = general contractor, MC = mechanical contractor, SC = sheet metal contractor, TAB = test and balance contractor.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

Notes:

_____ _____ _____ _____
Commissioning Agent Date Owner's Representative Date

2. Documentation submitted and approved: [All]

__ manufacturer's cut sheets
__ installation and checkout manual and plan
__ written copy of all control parameters, settings
__ written copy of all control parameters, settings and setpoints
__ O&M manual
__ performance data
__ design criteria

- ***Documentation complete as per contract documents.... ___ YES ___ NO***

3. Model verification

[Contr = _____]

	As Specified	As Submitted	As Installed
Service Entrance Switchboard			
Manufacturer			
Model No.	n/a	n/a	
Serial No.			
Transformers			
Manufacturer			
Model No.			
Serial No.			
UPS			
Manufacturer			
Model No.			
Serial No.			
Motor Starters			
Manufacturer			
Model No.			
Serial No.			
Panelboards			
Manufacturer			
Model No.			

Notes:

Serial No.			

- ***The equipment installed matches the specifications for given trade___ YES ___ NO***

4. Physical Installation Checks

4.1. Checks

Check if Okay. Enter comment or note number if deficient.

Check	Y / N	Contr.
General installation		
General appearance good, no apparent damage		
Equipment labels affixed		
Wiring Devices		
Receptacle properly grounded		
Cover plate installed		
Service Entrance Switchboard		
Terminal phasing identified		
Cable phase identified correctly		
Cable connection complete		
Code required clearances met		
Proper grounding		
Drip hood installed		
Owner's metering installed		
Door covers installed		
Interior and exterior cleaned		
Dry Type Transformers		
Terminal phasing identified		
Cable phase identified correctly		
Vibration isolators installed		
Cable connection complete		
Adequate clearance		
Proper ventilation		
Proper grounding		

Notes:

Check	Y / N	Contr.
PET lug installed		
Enclosure type 3R		
Cleaned		
Motor Starter		
Copper busing		
Cable phase identified correctly		
Adequate clearances		
Properly grounded		
Auxiliary contacts		
BAS components installed		
Control wiring diagrams included		
Control transformer		
Cleaned		
Panelboards		
Filler piece in place		
Cable phase identified correctly		
Cable lugs bolted to MRT (manufacturer's recommended torque)		
Bus bolts torqued to MRT		
Properly grounded		
Spare breakers installed		
Panel directory typed and complete		
Hinged door and front cover installed		
Breaker lock on devices installed		
Breaker bolts torqued to MRT		
Cleaned		
UPS		
Installed per drawings		
Neutral and ground conductors properly sized and configured		
Battery polarity correct		

Notes:

Check	Y / N	Contr.
Painted circuit boards properly configured		
Wire connections complete and tight		
Notes:		

- ***The checklist items of Part 4 are all successfully completed for given trade:***

..... ___ YES ___ NO

5. Operational Checks (These augment manufacturer's list. This is not the function performance testing.)

5.1. Checks

Check if Okay. Enter comment or note number if deficient.

Check	Y / N	Contr.
Wiring Devices		
Receptacle polarity tested		
GFCI Tested		
Voltage drop tested within tolerances		
Service Entrance Switchboard		
Insulation resistance measured		
Breaker switch opens and closes circuit properly		
Main breaker field set points adjusted		
Voltage and current measured within acceptable limits		
Dry Type Transformer		
Taps set correctly		
Ventilation operating		
Voltage and currents measured within acceptable limits		

Notes:

Check	Y / N	Contr.
Motor Starters		
H.O.A. switches operate as intended		
Voltage and current measured within acceptable limits		
UPS		
Input voltage and phase rotation correct		
Cooling system operational		
Bypass switch operates as intended		
Confirm transfer from normal to battery power		
Confirm run time at full load		
Notes:		

- ***The checklist items of Part 5 are all successfully completed for given trader:***

..... ___ YES ___ NO

END OF POWER DISTRIBUTION SYSTEM PREFUNCTIONAL CHECKLIST

Notes:

PC-___ LIGHTING AND LIGHTING CONTROL SYSTEM

Associated checklists: _____

1. Submittal / Approvals

Submittal. The above equipment and systems integral to them are complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This prefunctional checklist is submitted for approval, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. None of the outstanding items preclude safe and reliable functional tests being performed.___ List attached.

_____	_____	_____	_____
Electrical Contractor	Date	General Contractor	Date

Prefunctional checklist items are to be completed as part of startup & initial checkout, preparatory to functional testing.

- This checklist does not take the place of the manufacturer's recommended checkout and startup procedures or report.
- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = architect/engineer, All = all contractors, CA = commissioning agent, CC = controls contractor, EC = electrical contractor, GC = general contractor, MC = mechanical contractor, SC = sheet metal contractor, TAB = test and balance contractor.

Approvals. This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

_____ _____ _____ _____

Notes:

Commissioning Agent Date Owner's Representative Date

2. Documentation submitted and approved: [All]

__ manufacturer's cut sheets
__ installation and checkout manual and plan
__ full written sequences and list of all control strategies
__ written copy of all control parameters, Settings and setpoints
__ O&M manual
__ performance data
__ operating manual
__ completed control drawings
__ design criteria

- ***Documentation complete as per contract documents.... ___ YES ___ NO***

3. Model verification

[Contr = _____]

	As Specified	As Submitted	As Installed
Manufacturer			
Model No.			
Serial No.	n/a	n/a	

- ***The equipment installed matches the specifications for given trade.. ___ YES ___ NO***

4. Physical Installation Checks

Check if Okay. Enter comment or note number if deficient.

Check	**Y / N**	**Contr.**
Layout and locations match drawings		
Luminaires connected to lighting circuits		
Separate conduit systems provided for dimming control wire and cable		
Control devices installed and wired		

Notes:

Check	Y / N	Contr.
Notes:		

- ***The checklist items of Part 4 are all successfully completed for given trade***

  ___ ***YES*** ___ ***NO***

5. Optional Checks (These augment manufacturer's list. This is not the functional performance testing)

All field-installed temperature, relative humidity, CO, CO_2 and pressure sensors and gages, and all actuators (dampers and valves) shall be calibrated using the methods and tolerances given in the "Calibration and Leak-by Test Procedures" document. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed *in* a packaged unit at the factory with calibration certification provided need not be field calibrated. All calibrations shall be fully documented, including initial and final readings, offsets etc., on prefunctional checklist or other suitable forms.

Notes:

Check	Y / N	Contr.
Controls turn on/off light as intended		
Dimming control operates as intended		
Notes:		

- ***The checklist items of Part 5 are all successfully completed for given trade***

  ___ ***YES*** ___ ***NO***

END OF LIGHTING AND LIGHTING CONTROLS PREFUNCTIONAL CHECKLIST

Notes:

Project:_____

FT-_____ BASEBOARD HEATERS

1. Participants

Party	Participation

Party filling out this form and witnessing testing _____

Date of test _____

2. Prerequisite Checklist

a. __ All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final setpoints, schedules, debugging, loop tuning and sensor calibrations complete.

_____ _____
Controls Contractor Signature or Verbal Date

b. __ All A/E punch list items for this equipment corrected.
c. __ Safeties and operating ranges reviewed.
d. __ Test requirements and sequences of operation attached.
e. __ Schedules and setpoints attached.
f. __ Have all energy savings control strategies, setpoints and schedules been incorporated that this equipment and control system are capable of? If not, list recommendations below.
g. __ **BAS Program Review.** Review the BAS software control program(s) for this equipment. Parameters, setpoints and logic sequences appear to follow the specified written sequences.
h. __ **Packaged Control Program Review.** Review the packaged control program(s) for this equipment. Parameters, setpoints and logic sequences appear to follow the specified written sequences.
i. __ Record of All Values for Current Setpoints (SP), Control Parameters, Limits, Delays, Lockouts, Schedules, Etc. Changed to Accommodate Testing:

Parameter	**Pre-Test Values**	**Returned to Pre-Test Values √**	**Parameter**	**Pre-Test Values**	**Returned to Pre-Test Values √**

Notes:

ON setpoint		
OFF setpoint		

ON setpoint		
OFF setpoint		

3. Sensor Calibration Checks. Check the sensors listed below for calibration and adequate location. This is a sampling check of calibrations done during prefunctional checklisting. Test the packaged controls and BAS readings.

"In calibration" means making a reading with a calibrated test instrument within 6 inches of the site sensor. Verify that the sensor reading (via the permanent thermostat, gage, packaged control panel or building automation system (BAS)) compared to the test instrument-measured value is within the tolerances specified in the prefunctional checklist requirements (_____).

Sensor & Location	Loc-ation OK[1]	**1st** Gage or Pkg & BAS Values	Instru Meas'd Value	**Final** Gage or Pkg & BAS Values	Pass Y/N?
Stat temp.		Stat:		Stat:	

[1]Sensor location is appropriate and away from causes of erratic operation.

4. Device Calibration Checks.

5. Verification of Misc. Prefunctional Checks.

Misc. site checks of the prefunctional checklist and startup reports completed successfully.

Pass? Y / N _____

__ Unit mounted securely. __ Unit accessible for servicing. __ No unusual noise or vibration in fan.

Notes:

6. Functional Testing Record

Proced. No. & Spec. Seq. ID[1]	**Req ID No.[2]**	**Test Procedure[3]** (including special conditions)	**Expected and Actual Response[4]** [Write ACTUAL response in brackets or circle]	**Pass Y/N & Note #**

Record Foot Notes

[1]Sequences of operation specified in Contract Documents (attached).

[2]Mode or function ID being tested, per testing requirements section of the project Specifications.

[3]Step-by-step procedures for manual testing, trend logging or data-logger monitoring.

[4]Include tolerances for a passing condition.

[5]Record any permanently changed parameter values and submit to Owner.

END OF TEST

Notes:

1.01 GENERAL

.1 Submit final Functional Test Procedures forms to CA for approval.

.2 Contractor may use included sample forms for developing final procedures.

.3 Submit forms for each system intended to be commissioned as listed in commissioning plan and specification section 01 91 13.

.4 Submit blank forms well in advance of any scheduled test for review and approval.

.5 Make the necessary modifications to the blank forms as instructed by the CA.

1.02 FORMS

.1 The following form is attached at the end of this Section:
  .1 Power Distribution System
  .2 Lighting and Lighting Controls.

END OF SECTION

Project:_____

FT-_____ POWER DISTRIBUTION SYSTEM

1. Participants

Party	Participation
_____	_____
_____	

Party filling out this form and witnessing testing _____

Date of test _____

2. Prerequisite Checklist

a. __ All system functions for this and all interlocking systems are operable per contract documents.

_____ _____
Electrical Contractor Signature or Verbal Date

b. __ All A/E punch list items for this equipment corrected.
c. __ Safeties and operating ranges reviewed.
d. __ Test requirements and sequences of operation attached.
e. __ Schedules and setpoints attached.
f. __ Have all energy savings control strategies, setpoints and schedules been incorporated that this equipment and control system are capable of? If not, list recommendations below.
g. __ **Packaged Control Program Review.** Review the packaged control program(s) for this equipment. Parameters, setpoints and logic sequences appear to follow the specified written sequences.
h. __ Record of All Values for Current Setpoints (SP), Control Parameters, Limits, Delays, Lockouts, Schedules, Etc. Changed to Accommodate Testing:

3. Sensor Calibration Checks.

NONE

4. Device Calibration Checks.

NONE

Notes:

5. Verification of Misc. Prefunctional Checks.

Misc. site checks of the prefunctional checklist and startup reports completed successfully.

Pass? Y / N _____

__ Unit mounted securely. __ Unit accessible for servicing. __ No unusual noise or vibration

6. Functional Testing Record

Proced. No. & Spec. Seq. ID[1]	**Req ID No.[2]**	**Test Procedure[3]** (including special conditions)	**Expected and Actual Response[4]** [Write ACTUAL response in brackets or circle]	**Pass Y/N & Note #**

Record Foot Notes

[1]Sequences of operation specified in Contract Documents (attached).

[2]Mode or function ID being tested, per testing requirements section of the project Specifications.

[3]Step-by-step procedures for manual testing, trend logging or data-logger monitoring.

[4]Include tolerances for a passing condition.

[5]Record any permanently changed parameter values and submit to Owner.

END OF TEST

Notes:

FT-_____ LIGHTING CONTROLS

1. Participants

Party	Participation
_____	_____
_____	

Party filling out this form and witnessing testing _____

Date of test _____

2. Prerequisite Checklist

a.__ All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final setpoints, schedules, debugging and fine tuning of photo-cell parameters.

_____ _____
Controls Contractor Signature or Verbal Date

b.__ All A/E punch list items for this equipment corrected.
c.__ Safeties and operating ranges reviewed.
d.__ Test requirements and sequences of operation attached.
e.__ Schedules and setpoints attached.
f.__ Have all energy savings control strategies, setpoints and schedules been incorporated that this equipment and control system are capable of? If not, list recommendations below.
g. __ **BAS Program Review.** Review the BAS software control program(s) for this equipment. Parameters, setpoints and logic sequences appear to follow the specified written sequences.
h.__ Schedule of fixtures on each control type (Parking or Security) has been reviewed.
i.__ Record of All Values for Current Setpoints (SP), Control Parameters, Limits, Delays, Lockouts,
Schedules, Etc. Changed to Accommodate Testing:

Notes:

Parameter	Pre-Test Values	Returned to Pre-Test Values √

Parameter	Pre-Test Values	Returned to Pre-Test Values √

3. Sensor Calibration Checks. Check the sensors listed below for calibration and adequate location. This is a sampling check of calibrations done during prefunctional checklisting. Test the packaged controls and BAS readings.

NONE

4. Device Calibration Checks.

NONE

5. Verification of Misc. Prefunctional Checks.

Misc. site checks of the prefunctional checklist and startup reports completed successfully.
Pass? Y / N _____
__ Photo-cell (PC) mounted securely. __ PC mounted where it won't be tampered with. __ PC mounted so it won't become dirty easily.
__ PC accessible for servicing.

6. Functional Testing Record

Proced. No. & Spec. Seq. ID[1]	Req ID No.[2]	Test Procedure[3] (including special conditions)	Expected and Actual Response[4] [Write ACTUAL response in brackets or circle]	Pass Y/N & Note #

Record Foot Notes
[1]Sequences of operation specified in Contract Documents (attached).

Notes:

[2]Mode or function ID being tested, per testing requirements section of the project Specifications.
[3]Step-by-step procedures for manual testing, trend logging or data-logger monitoring.
[4]Include tolerances for a passing condition.
[5]Record any permanently changed parameter values and submit to Owner.

END OF TEST

Notes: