

SPECIFICATIONS:

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Part 1 General

1.1 Work Covered by Contract Documents

- .1 Work of this Contract comprises renovation of greenhouse supplementary lighting systems, located at 107 Science Place, Saskatoon, SK ; and further identified as the Saskatoon Research and Development Centre.

1.2 Work by Others

- .1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from the Departmental representative.
- .2 Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to the Departmental representative, in writing, any defects which may interfere with proper execution of Work.

1.3 Work Sequence

- .1 Construct Work in stages to accommodate Owner's intermittent use of premises during construction.
- .2 Co-ordinate Progress Schedule and co-ordinate with Owner Occupancy during construction.
- .3 Contractor will have access to one greenhouse at a time, with approval required from the Departmental representative before commencing work in each location. The Departmental representative will determine the specific order of greenhouse availability to best suit the research requirements.
- .4 Required stages:
 - .1 Greenhouse A –Construction and Commissioning – maximum 5 days.
Rotation – 1 day.
 - .2 Greenhouse B –Construction and Commissioning – maximum 5 days.
Rotation – 1 day.
 - .3 Greenhouse C –Construction and Commissioning – maximum 5 days.
Rotation – 1 day
 - .4 Greenhouse D –Construction and Commissioning – maximum 5 days.
Rotation – 1 day.
 - .5 Greenhouse E –Construction and Commissioning – maximum 5 days.
Rotation – 1 day.

- .5 The Contractor shall provide a detailed construction schedule in Barr Gantt chart format for review by the Departmental representative at the start of the project. Update schedule following each phase.

1.4 Existing Work

- .1 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .2 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by the Departmental representative.
- .3 At completion of operations, condition of existing work shall be equal to or better than that which existed before new work started.

1.5 Owner Furnished Items

- .1 Owner Responsibilities:
 - .1 The Owner will not supply any Materials for this contract.
- .2 Contractor Responsibilities:
 - .1 Designate submittals and delivery date for each product in progress schedule.
 - .2 Review shop drawings, product data, samples, and other submittals. Submit to the Departmental representative notification of observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
 - .3 Receive and unload products at site.
 - .4 Inspect deliveries jointly with Departmental representative; record shortages, and damaged or defective items.
 - .5 Handle products at site, including uncrating and storage.
 - .6 Protect products from damage, and from exposure to elements.
 - .7 Assemble, install, connect, adjust, and finish products.
 - .8 Provide installation inspections required by public authorities.
 - .9 Repair or replace items damaged by Contractor or subcontractor on site (under his control).

1.6 Documents Required

- .1 Maintain at job site, one copy each document as follows:
 - .1 Contract Drawings.

- .2 Specifications.
- .3 Addenda.
- .4 Reviewed Shop Drawings.
- .5 List of Outstanding Shop Drawings.
- .6 Change Orders.
- .7 Other Modifications to Contract.
- .8 Field Test Reports.
- .9 Copy of Approved Work Schedule.
- .10 Health and Safety Plan and Other Safety Related Documents.
- .11 Other documents as specified.

Part 2 Products

- .1 Not Used

Part 3 Execution

- .1 Not Used

END OF SECTION

Part 1 General

1.1 Access and Egress

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

1.2 Use of Site and Facilities

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
 - .1 Construct work in stages to provide for continuous usage of other greenhouses. Do not restrict use of other greenhouses, or facilities during construction.
 - .2 Additional greenhouses will not be made available to the Contractor until satisfactory performance of completed greenhouses has been demonstrated.
- .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 The Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.
- .5 Parking will be permitted onsite in an area designated by the Departmental Representative
- .6 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

1.3 Owner Occupancy

- .1 Owner will occupy premises during entire construction period for execution of normal operations.
- .2 Co-operate with Departmental representative in scheduling operations to minimize conflict and to facilitate Owner usage.

1.4 Partial Owner Occupancy

- .1 Schedule and substantially complete designated phases of Work for Owner's occupancy prior to Substantial Performance of entire Work.
- .2 Execute Certificate of Substantial Performance for each designated phase of Work prior to Owner occupancy. Each greenhouse is treated as a single phase of work and will have separate certificates of substantial performance. Contractor shall allow:
 - .1 Access for Owner personnel.
 - .2 Operation of HVAC and electrical systems.

.3 On occupancy, Owner will provide for occupied areas:

- .1 Operation of HVAC and electrical systems.
- .2 Maintenance.
- .3 Security.

1.5 Alterations, Additions or Repairs to Existing Building

- .1 Execute work with least possible interference or disturbance to building operations and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.
- .2 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of the Departmental representative.

1.6 Existing Services

- .1 Provide alternative routes for personnel.
- .2 Establish location and extent of service lines in area of work before starting Work. Notify the Departmental representative of findings.
- .3 Submit schedule to and obtain approval from the Departmental representative for any shut-down or closure of active service or facility including lighting, power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .4 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .5 Where Work involves breaking into or connecting to existing services, give the Departmental representative 48 hours' notice. Minimize duration of interruptions. Carry out work at times as directed by Departmental Representative with minimum disturbance to building operations.
- .6 Record locations of maintained, re-routed and abandoned service lines.
- .7 Where unknown services are encountered, immediately advise the Departmental representative and confirm findings in writing.
- .8 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by Departmental Representative.

1.7 Special Requirements

- .1 Access to the jobsite shall be permitted Monday to Friday from 8:00 to 17:00 hours only.
- .2 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

- .3 Keep within limits of work and avenues of ingress and egress.
- .4 Deliver materials outside of peak traffic hours, 17:00 to 07:00, unless otherwise approved by Departmental Representative.

1.8 Security

- .1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.
- .2 Security clearance and escort:
 - .1 Personnel employed on this project must be security cleared, or be escorted when executing work in non-public areas.
 - .2 Submit an escort request to Departmental Representative at least 24 hours before service is needed.
 - .3 Personnel will be checked daily at start of work shift and provided with pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.
 - .4 The Departmental Representative reserves the right the request further security screening of contractor personnel, on behalf of the Owner, at no additional cost to the contractor, if it is deemed necessary.

1.9 Building Smoking Environment

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

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 Administrative Responsibilities

- .1 The Departmental Representative will be responsible for administrative requirements for the following Project meetings:
 - .1 Preconstruction
 - .2 Progress
- .2 The Contractor shall be responsible for administrative requirements for the following Project meetings:
 - .1 Workplace Orientation
 - .2 Safety
- .3 The Owner will be responsible for providing a physical location for project construction meetings, at the project site.

1.2 Administrative Requirements

- .1 Schedule and administer project meetings throughout the progress of the Work.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting seven days in advance of meeting date.
- .4 Preside at meetings.
- .5 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .6 Reproduce and distribute copies of minutes within seven (7) days after meetings and transmit to meeting participants and affected parties not in attendance.
- .7 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.3 Preconstruction Meeting

- .1 Within 15 days after award of Contract and prior to commencement of activities at the Jobsite.
- .2 Purpose: To discuss personnel assignments and administrative procedures and responsibilities.
- .3 Attendees: Departmental representatives, Contractor, major Subcontractors, field Inspectors and supervisors.

- .4 Establish time of meeting at site location and notify parties concerned minimum 5 days before meeting.
 - .1 Agenda to include:
 - .2 Appointment of official representative of participants in the Work.
 - .3 Schedule of Work: Bar (GANTT) Chart.
 - .4 Schedule of submission of Shop Drawings, and product data. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .5 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with 01 52 00 - Construction Facilities.
 - .6 Jobsite security.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .8 Record Drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .9 Monthly progress claims, administrative procedures, photographs, hold backs.
 - .10 Appointment of inspection and testing agencies or firms.
 - .11 Insurances, transcript of policies.

1.4 Progress Meetings

- .1 During course of Work schedule progress meetings weekly.
- .2 Contractor, major Subcontractors involved in Work, and Departmental representatives are to be in attendance.
- .3 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 7 days after meeting.
- .4 Agenda may 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 project schedule.

- .7 Revision to construction schedule.
- .8 Progress schedule for succeeding Work period.
- .9 Review submittal schedules: expedite as required.
- .10 Maintenance of quality standards.
- .11 Review proposed changes for effect on construction schedule and on Completion Date.
- .12 Safety issues.
- .13 Environmental issues.
- .14 Other business.

1.5 Workplace Orientation Meetings

- .1 Frequency: As required for all new workers prior to commencement of working on Jobsite.
- .2 Purpose: To familiarize new workers with Jobsite conditions, rules, regulations, safety and security requirements.
- .3 Attendees: All new Contractor personnel scheduled to Work on the Jobsite.
- .4 Agenda may include the following:
 - .1 Project description including areas of Work.
 - .2 Hazardous areas including open excavations, construction Equipment traffic, blasting, storage of chemicals or explosives, etc.
 - .3 Safety Equipment to be worn by workers.
 - .4 Traffic rules on the Jobsite.
 - .5 Evacuation procedures.
 - .6 First aid procedures.
 - .7 Excavation or Work permit procedures.
 - .8 WHMIS requirements for storage and handling of chemicals.
 - .9 Fire safety rules and regulations.
 - .10 Rules and regulations regarding wildlife, environmental concerns, drugs, alcohol, etc.

1.6 Safety Meetings

- .1 Frequency: Weekly during the course of the Work for each area of the Work.
- .2 Purpose: To review safety concerns and implement safety measures.
- .3 Contractor, major Subcontractors involved in Work, and Departmental representatives are to be in attendance.
- .4 Agenda may include the following:
 - .1 Review and discussion of safety concerns, accidents and “near misses”.
 - .2 Remedial or preventative actions to be taken.

Part 2 Products

- .1 Not Used

Part 3 Execution

- .1 Not Used

END OF SECTION

Part 1 General

1.1 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.

1.2 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.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Submit to Departmental Representative within 15 days after award of Contract and prior to commencement of activities at the Jobsite.
- .3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.4 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 5 working days.
- .3 Revise impractical schedule and resubmit within 5 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.5 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Excavation.
 - .6 Backfill.
 - .7 Building footings.
 - .8 Slab on grade.
 - .9 Structural Steel.
 - .10 Siding and Roofing.
 - .11 Interior Architecture (Walls, Floors and Ceiling).

- .12 Plumbing.
- .13 Lighting.
- .14 Electrical.
- .15 Piping.
- .16 Controls.
- .17 Heating, Ventilating, and Air Conditioning.
- .18 Millwork.
- .19 Fire Systems.
- .20 Testing and Commissioning.
- .21 Supplied equipment long delivery items.
- .22 Engineer supplied equipment required dates.

1.6 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on bi-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.

1.7 PROJECT MEETINGS

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

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 Administrative

- .1 Submit to the 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 Review submittals prior to submission to the 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.
- .4 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .5 Notify the Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .6 Verify field measurements and affected adjacent Work are co-ordinated.
- .7 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental representative review of submittals.
- .8 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental representative review.
- .9 Keep one reviewed copy of each submission on the Jobsite.

1.2 Shop Drawings and Product Data

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 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.
- .3 Allow 10 Working Days for Departmental Representative review of each submission.
- .4 Adjustments made throughout Shop Drawings by the Departmental Representative are not intended to change the Contract Price. If adjustments affect value of Work, state such in writing to the Departmental Representative prior to proceeding with Work.

- .5 Make changes in shop drawings as required by the Departmental Representative, consistent with Contract Documents. When resubmitting, notify the Departmental Representative in writing of revisions other than those requested.
- .6 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each Shop Drawing, product data and sample.
 - .5 Other pertinent data.
- .7 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
- .8 After the Departmental Representative review, distribute copies.
- .9 Submit electronic copies of product data sheets or brochures for requirements requested in Specification Sections and as requested by the Departmental Representative where Shop Drawings will not be prepared due to standardized manufacture of product.
- .10 Submit electronic copies of test reports for requirements requested in Specification Sections and as requested by the 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.
- .11 Submit electronic copies of certificates for requirements requested in Specification Sections and as requested by the 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.
- .12 Submit electronic copies of manufacturer's instructions for requirements requested in Specification Sections and as requested by the 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.
- .13 Submit electronic copies of Manufacturer's Field Reports for requirements requested in Specification Sections and as requested by the Departmental Representative.
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .14 Submit electronic copies of Operation and Maintenance Data for requirements requested in Specification Sections and as requested by the Departmental Representative.
- .15 Delete information not applicable to project.
- .16 Supplement standard information to provide details applicable to project.
- .17 If upon review by the 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.
- .18 The review of any submittal by the Departmental Representative is regarded as assistance.
 - .1 This review shall not mean that the 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 Jobsite, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of Work of sub-trades.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 Reference Standards

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Province of Saskatchewan
 - .1 Occupational Health and Safety Act, 1993, S.S.

1.2 Action and Informational Submittals

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks.
- .3 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .4 Submit copies of incident and accident reports.
- .5 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor.
- .6 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.
- .7 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.3 Filing of Notice

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.
- .2 Contractor shall be responsible and assume the Principal Contractor role for each work zone location and not the entire complex. Contractor shall provide a written acknowledgement of this responsibility with 3 weeks of contract award.
- .3 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.4 Safety Assessment

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

1.5 Meetings

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

1.6 Regulatory Requirements

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

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

1.10 Unforeseen Hazards

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

- .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.

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 Work Stoppage

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

Part 2 Products

- .1 Not used.

Part 3 Execution

- .1 Not used.

END OF SECTION

Part 1 General

- .1 This Section references to laws, by laws, ordinances, rules, regulations, codes, orders of Authority Having Jurisdiction, and other legally enforceable requirements applicable to Work and that are; or become, in force during performance of Work.

1.2 References to Regulatory Requirements

- .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 Specific design and performance requirements listed in specifications or indicated on Drawings may exceed minimum requirements established by referenced Building Code; these requirements will govern over the minimum requirements listed in Building Code
 - .1 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.3 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 the Departmental Representative.
- .2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify the Departmental Representative.
- .3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify the Departmental Representative.

1.4 Quality Assurance

- .1 Regulatory Requirements: Except as otherwise specified, Constructor will apply for, obtain, and pay fees associated with, permits, licenses, certificates, and approvals required by regulatory requirements and Contract Documents, based on General Conditions of Contract and the following:
 - .1 Regulatory requirements and fees in force on date of Bid submission, and
 - .2 A change in regulatory requirements or fees scheduled to become effective after date of tender submission and of which public notice has been given before date of tender submission

Part 2 Products

- .1 Not Used.

Part 3 Execution

.1 Not Used.

END OF SECTION

Part 1 General

1.1 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.
- .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 will pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged 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 reinspection.

1.3 ACCESS TO WORK

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

1.4 PROCEDURES

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

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

1.5 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative 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, Owner 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.

1.6 REPORTS

- .1 Submit electronic copies of inspection and test reports to Departmental Representative.

1.7 TESTS AND MIX DESIGNS

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

1.8 MOCK-UPS

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Construct in locations acceptable to Departmental Representative.
- .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.

1.9 MILL TESTS

- .1 Submit mill test certificates as required of specification Sections.

1.10 EQUIPMENT AND SYSTEMS

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 Installation and Removal

- .1 Prepare Jobsite plan indicating any proposed locations 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 Indicate use of supplemental or other staging area.
- .3 Provide construction facilities in order to execute Work expeditiously.
- .4 Remove from Jobsite all such Work after use.

1.2 Scaffolding

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain ramps, scaffolding, ladders and platforms

1.3 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 Maintain storage sheds at ambient temperature and humidity appropriate to the manufacturer datasheets of the materials being stored
- .3 Locate Materials not required to be stored in weatherproof sheds onsite in manner to cause least interference with Work activities. Do not unreasonably encumber premises with products.

1.4 Clean-Up

- .1 Remove construction debris, waste Materials, packaging material from Jobsite daily.
- .2 Clean dirt or mud tracked onto the jobsite and work areas.
- .3 Store Materials resulting from demolition activities that are salvageable.
- .4 Stack stored new or salvaged material not in construction facilities.

2.0 Products

- .1 Not used

3.0 Execution

3.1 Jobsite Restoration

- .1 Upon completion of Work, remove all temporary construction facilities and restore the Jobsite to a condition acceptable to the Departmental Representative.

END OF SECTION

Part 1 General

1.1 Reference Standards

- .1 Within text of each specifications section, reference may be made to reference standards.
- .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, the 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 the Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 Quality

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

1.3 Availability

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify the 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 the Departmental representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Departmental representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 Storage, Handling and Protection

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Remove and replace damaged products at own expense and to satisfaction of the Departmental Representative.
- .5 Touch-up damaged factory finished surfaces to the Departmental Representative satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 Transportation

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

1.6 Manufacturer's Instructions

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

1.7 Quality of Work

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify the 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. The 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 the Departmental Representative, whose decision is final.

1.8 Co-ordination

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

1.9 Concealment

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

1.10 Remedial Work

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

1.11 Location of Fixtures

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

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 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.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not used

END OF SECTION

Part 1 General

1.1 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 Owner 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.
 - .9 Materials
- .4 Required for original installation.
- .5 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.2 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.

1.3 Execution

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

1.4 Waste Management and Disposal

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

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 Project Cleanliness

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

1.2 Final Cleaning

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.

- .4 Remove waste products and debris other than that caused by Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by the Departmental representative. Do not burn waste materials on site, unless approved by the Departmental representative.
- .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, and floors
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.
- .12 Inspect finishes, 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 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

1.3 Waste Management and Disposal

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

Part 2 Products

- .1 Not Used.

Part 3 Execution

.1 Not Used.

END OF SECTION

Part 1 General

1.1 Waste Management Goals

- .1 Prior to start of Work conduct meeting with the Departmental representative to review and discuss PSPC's waste management goal and Contractor's proposed Waste Reduction Workplan for Construction, Renovation and /or Demolition (CRD) waste to be project generated.
- .2 PSPC's waste management goal: to divert a minimum 75 percent of total Project Waste from landfill sites. Prior to project completion provide the Departmental representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.
- .3 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.
- .4 Protect environment and prevent environmental pollution damage.

1.2 Reference Standards

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

1.3 Definitions

- .1 Approved/Authorized recycling facility: waste recycler approved by applicable provincial authority or other users of material for recycling approved by the Departmental representative.
- .2 Class III: non-hazardous waste - construction renovation and demolition waste.
- .3 Construction, Renovation and/or Demolition (CRD) Waste: Class III solid, non-hazardous waste materials generated during construction, demolition, and/or renovation activities
- .4 Cost/Revenue Analysis Workplan (CRAW): based on information from Waste Reduction Workplan, and intended as financial tracking tool for determining economic status of waste management practices (Schedule E).
- .5 Inert Fill: inert waste - exclusively asphalt and concrete.
- .6 Waste Source Separation Program (WSSP): implementation and co-ordination of ongoing activities to ensure designated waste materials will be sorted into pre-defined categories and sent for recycling and reuse, maximizing diversion and potential to reduce disposal costs.
- .7 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .8 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .9 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .10 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .11 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .12 Separate Condition: refers to waste sorted into individual types.
- .13 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.
- .14 Waste Diversion Report: detailed report of final results, quantifying cumulative weights and percentages of waste materials reused, recycled and landfilled over course of project. Measures success against Waste Reduction Workplan (WRW) goals and identifies lessons learned.

- .15 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as co-ordinating required submittal and reporting requirements.
- .16 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials generated by project. Specifies diversion goals, implementation and reporting procedures, anticipated results and responsibilities. Waste Reduction Workplan (Schedule B) information acquired from Waste Audit.

1.4 Documents

- .1 Post and maintain in visible and accessible area at job site, one copy of following documents:
 - .1 Waste Reduction Workplan (Schedule B).
 - .2 Waste Source Separation Program.
 - .3 Schedule B completed for project.

1.5 Action and Informational Submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following:
 - .1 1 electronic copy of completed Waste Reduction Workplan (WRW): Schedule B.
 - .2 1 electronic copy of Cost/Revenue Analysis Workplan (CRAW): Schedule E.
 - .3 1 electronic copy of Waste Source Separation Program (WSSP).
- .3 Prepare and submit on monthly basis, throughout project or at intervals agreed to by the Departmental representative the following:
 - .1 Receipts, scale tickets, waybills, and/or waste disposal receipts that show quantities and types of materials reused, recycled, or disposed of.
 - .2 Updated Waste Materials Tracking form (Schedule D).
 - .3 Written 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 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.

1.6 Waste Reduction Work plan (WRW)

- .1 Prepare and submit WRW (Schedule B) at least 10 days prior to project start-up.
- .2 WRW identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations.
- .3 WRW should include but not limited to:
 - .1 Applicable regulations.
 - .2 Specific goals for waste reduction, identify existing barriers and develop strategies to overcome them.
 - .3 Destination of materials identified.
 - .4 Deconstruction/disassembly techniques and schedules.
 - .5 Methods to collect, separate, and reduce generated wastes.
 - .6 Location of waste bins on-site.
 - .7 Security of on-site stock piles and waste bins.
 - .8 Protection of personnel, sub-contractors.
 - .9 Clear labelling of storage areas.
 - .10 Training plan for contractor and sub-contractors.
 - .11 Methods to track and report results reliably (Schedule D).
 - .12 Details on materials handling and removal procedures.
 - .13 Recycler and reclaimer requirements.
 - .14 Quantities of materials to be salvaged for reuse or recycled and materials sent to landfill.
 - .15 Requirements for monitoring on-site wastes management activities.
- .4 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .5 Post WRW or summary where workers at site are able to review content.
- .6 Monitor and report on waste reduction by documenting total volume (in tonnes) and cost of actual waste removed from project (Schedule D).

1.7 Cost/Revenue Analysis Work plan (CRAW)

- .1 Prepare CRAW (see Schedule E) and include the following:
 - .1 Cost of current waste management practices.
 - .2 Implementation cost of waste diversion program.
 - .3 Savings and benefits resulting from waste diversion program.

1.8 Waste Source Separation Program (WSSP)

- .1 As part of Waste Reduction Workplan, prepare WSSP prior to project start-up.
- .2 WSSP will detail methodology and planned on-site activities for separation of reusable and recyclable materials from waste intended for landfill.
- .3 Provide list and drawings of locations that will be made available for sorting, collection, handling and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide sufficient on-site facilities and containers for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .5 Locate containers to facilitate deposit of materials without hindering daily operations.
- .6 Provide training for contractor in handling and separation of materials for reuse and/or recycling.
- .7 Locate separated materials in areas which minimizes material damage.
- .8 Clearly and securely label containers to identify types/conditions of materials accepted and assist workers in separating materials accordingly.
- .9 Monitor on-site waste management activities by conducting periodic site inspections to verify: state of signage, contamination levels, bin locations and condition, personnel participation, use of waste tracking forms and collection of waybills, receipts and invoices.
- .10 On-site sale of salvaged materials is not permitted unless authorized in writing by the Departmental representative and provided that site safety regulations and security requirements are adhered to.

1.9 Use of Site and Facilities

- .1 Execute Work with minimal interference and disturbance to normal use of premises.
- .2 Maintain security measures established by facility provide temporary security measures approved by the Departmental representative.

1.10 Waste Processing Sites

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

1.11 Quality Assurance

- .1 After award of Contract, a mandatory site examination will be held for this Project for Contractor and/or sub-contractors responsible for construction, renovation demolition/deconstruction waste management.
 - .1 Date, time and location will be arranged by the Departmental representative.
- .2 Waste Management Meeting: Waste Management Co-ordinator 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 and Waste Materials Tracking form in Schedule D).

1.12 Storage, Handling and Protection

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by the Departmental representative.
- .2 Unless specified otherwise, materials for removal do not become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed and salvaged materials from movement or damage.
- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify the Departmental representative.
- .7 Protect surface drainage, mechanical and electrical from damage and blockage.
- .8 Provide on-site facilities and containers for collection and storage of reusable and recyclable materials.
- .9 Separate and store materials produced during project in designated areas.
- .10 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated processing facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off site processing facility for separation.

- .3 Obtain waybills, receipts and/or scale tickets for separated materials removed from site.
- .4 Materials reused on-site are considered to be diverted from landfill and as such are to be included in all reporting.

1.13 Disposal of Wastes

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of oil, volatile materials, mineral spirits, paint thinner, waste into waterways, storm, or sanitary sewers.
- .3 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total tonnage generated.
 - .4 Tonnage reused or recycled.
 - .5 Reused or recycled waste destination.
- .4 Remove materials on-site as Work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in the waste audit.

1.14 Scheduling

- .1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

Part 2 Products

- .1 Not Used.

Part 3 Execution

3.1 Application

- .1 Do Work in compliance with WRW and WSSP.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 Diversion of Materials

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by the Departmental representative, and consistent with applicable fire regulations.
 - .1 Mark containers or stockpile areas.
 - .2 Provide instruction on disposal practices.
- .2 On-site sale of salvaged material is not permitted.

3.3 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.

3.4 Waste Reduction Work plan (WRW)

- .1 Schedule B

(1) Material Category	(2) Person(s) Responsible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s) Destination
Wood and Plastics Material Description							
Chutes							
Warped Pallet Forms							
Plastic Packaging							
Card- board Packaging							
Light Fixtures							
Electrical Wiring							
Light Bulbs							

(1) Material Category	(2) Person(s) Responsible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s) Destination
Light Bulbs - HPS							
Wood							
Metal							
Other							

3.5 Cost Revenue Analysis Workplan (CRAW)

.1 Schedule E - Cost/Revenue Analysis Workplan (CRAW)

(1) Material Description	(2) Total Quantity (unit)	(3) Volume (cum)	(4) Weight (cum)	(5) Disposal Cost/Credit \$(+/-)	(6) Category Sub-Total \$(+/-)
Wood					
Light Fixtures					
Electrical Wiring					
Light Bulbs					
Light Bulbs - HPS					
Metal					
		(7) Cost (-) / Revenue (+)			\$

3.6 Canadian Governmental Departments Chief Responsibility for the Environment

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

Province	Address	General Inquires	Fax
Saskatchewan	Saskatchewan Environment and Resource Management 3211 Albert Street Regina SK S4S 5W6	306-787-2700	306-787-3941

END OF SECTION

Part 1 General

1.1 Process

- .1 A Contract acceptance process will be used to facilitate the Departmental representative acceptance of the Work. The process can be summarized as follows:
 - .1 Substantial Performance of the Work:
 - .1 Fulfilment of prerequisites to Substantial Performance.
 - .2 Inspection for Substantial Performance.
 - .3 Issuance of a Certificate of Substantial Performance of the Work.
 - .2 Total Performance of the Work:
 - .1 Fulfilment of prerequisites to Total Performance.
 - .2 Inspection for Total Performance.
 - .3 Issuance of a Certificate of Total Performance of the Work.
 - .3 Warranty Performance of the Work:
 - .1 Fulfilment of prerequisites to Warranty Performance.
 - .2 Inspection for Warranty Performance.
 - .3 Issuance of Certificate of Warranty Performance of the Work.

1.2 Substantial Performance of Part of the Permanent Work

- .1 When utilization of part of the Permanent Work is required and Substantial Performance of part of the Permanent Work is a condition of such utilization, the applicable requirements specified in this section will apply to the part of the Permanent Work to be utilized.

1.3 Prerequisites to Substantial Performance

- .1 Prior to requesting the Departmental representative inspection for Substantial Performance carry out the following:
 - .1 Perform canopy and greenhouse commissioning.
 - .2 Obtain and submit evidence of compliance with Regulatory Requirements.
 - .3 Remove from the Jobsite surplus products, construction tools, Equipment, mock-ups, and similar items not required for the performance of the remaining Work.
 - .4 Correct all Contract Deficiencies that may affect operation of the facility.

- .5 Complete the Work and have it ready for the purpose intended Special Provisions – Clause 6.
 - .6 Carry out Owner training.
 - .7 Fully satisfy requirements as set forth in Builder's Lien Act.
 - .8 Review the Contract Documents and inspect the Work to confirm that prerequisites to Substantial Performance have been fulfilled and that the Work is ready for inspection for Substantial Performance.
- .2 Work that does not need to be completed prior to Substantial Performance are:
- .1 Final clean-up
 - .2 Record Documents
 - .3 Product warranties
 - .4 Removal of the Jobsite storage and temporary facilities

1.4 Inspection for Substantial Performance

- .1 Submit a written request to the Departmental representative for inspection for Substantial Performance, certifying that prerequisites have been fulfilled and specifying known exceptions in the form of a list of items to be completed, corrected, or submitted.
- .2 The Departmental representative will, within a reasonable time after receipt of the Contractor's request:
 - .1 Proceed with the inspection; or
 - .2 Advise the Contractor that prerequisites are not adequately fulfilled.
 - .3 Results of the Departmental representative inspection for Substantial Performance will form the Substantial Performance Contract Deficiency List (SPC Deficiency List).

1.5 Substantial Performance of the Work

- .1 Following inspection, the Departmental representative will:
 - .1 Issue a Certificate of Substantial Performance of the Work stating the effective date of Substantial Performance, with a copy of the SPC Deficiency List attached; or
 - .2 Advise the Contractor that prerequisites to Substantial Performance are not fulfilled and repeat the inspection for Substantial Performance as necessary.
- .2 Upon issuance of a Certificate of Substantial Performance of the Work, the Owner will assume responsibility for care, custody, and control of the Work that has been completed, including responsibility for the following:

- .1 Operation, including all systems and Equipment.
- .2 Maintenance.
- .3 Property insurance.

1.6 Prerequisites to Total Performance

- .1 Prior to requesting the Departmental representative inspection for Total Performance carry out the following:
 - .1 Perform the entire Work including the following:
 - .1 Final clean-up
 - .2 Record documents
 - .3 Product warranties
 - .4 Operation and maintenance manuals
 - .5 Correction of all Contract Deficiencies except those items arising from the Warranty provisions of the Contract Documents.
 - .6 Removal of the Jobsite storage and temporary facilities
- .2 Review the Contract Documents and inspect the Work to confirm that prerequisites to Total Performance have been met and that the Work is ready for inspection for Total Performance.

1.7 Inspection for Total Performance

- .1 Submit a written request to the Departmental representative for inspection for Total Performance, including a copy of the Departmental representative's most recent deficiency List, and certify that each Contract Deficiency has been corrected or otherwise resolved in a manner agreed to between the Departmental representative and the Contractor. List known exceptions, if any, in the request.
- .2 The Departmental representative will, within a reasonable time after receipt of the Contractor's request:
 - .1 Proceed with the inspection; or
 - .2 Advise the Contractor that prerequisites are not adequately fulfilled.

1.8 Total Performance of the Work

- .1 Following the inspection, the Departmental representative will:
 - .1 Issue a Certificate of Total Performance of the Work, stating the effective date of Total Performance; or

- .2 Advise the Contractor of Contract Deficiencies that must be corrected prior to issuance of a Certificate of Total Performance of the Work.
- .2 Following receipt of the Certificate of Total Performance, submit all items listed in GP 34, GP 35 and GP 36 if not already provided.

1.9 Prerequisites to Warranty Performance

- .1 The prerequisites to Warranty Performance are:
 - .1 Total Performance of the Work;
 - .2 Expiry of the Warranty period; and
 - .3 Correction of items arising from the Warranty period required by the Contract Documents.

1.10 Inspection for Warranty Performance

- .1 Just prior to the end of the Warranty period, the Departmental representative will conduct an inspection for Warranty Performance.

1.11 Warranty Performance of the Work

- .1 Following the inspection, the Departmental representative will:
 - .1 Issue a Certificate of Warranty Performance of the Work; or
 - .2 Advise the Contractor of items that must be corrected prior to issuance of the Certificate of Warranty Performance of the Work.

Part 2 Products

- .1 Not used

Part 3 Execution

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 Administrative Requirements

- .1 Pre-Warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with contractor's Representative and the Departmental Representative, in accordance with 01 31 19 - Project Meetings to:
 - .2 Verify project requirements.
 - .3 Review manufacturer's installation instructions and Warranty requirements.
 - .4 The Departmental Representative to establish communication procedures for:
 - .5 Notifying construction Warranty defects.
 - .6 Determine priorities for type of defects.
 - .7 Determine reasonable response time.
 - .8 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.
 - .9 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for Warranty Work action.

1.2 Action and Informational Submittals

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

1.3 Format

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.

- .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of Equipment.
- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.
- .9 Electronic submission in .pdf format, merged into a single file.

1.4 Contents - Project Record Documents

- .1 Table of Contents for each volume: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses and telephone numbers of Departmental Representative 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 01 45 00 - Quality Control.

1.5 As -Built Documents and Samples

- .1 Maintain, in addition to requirements in general provisions, at jobsite 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 the Departmental Representative.

1.6 Recording Information on Project Record Documents

- .1 Record information on set of black line opaque drawings, provided by the Departmental Representative.
- .2 Use felt tip marking pens, maintaining separate colors for each major system, for recording information.
- .3 Record information concurrently with construction progress.
 - .1 Do not conceal work until required information is recorded.
- .4 Contract drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

- .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
- .4 Field changes of dimension and detail.
- .5 Changes made by change orders.
- .6 Details not on original contract drawings.
- .7 References to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by addenda and change orders.
- .6 Other documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual Specifications sections.
- .7 Provide digital photos, if requested, for Jobsite records.

1.7 Equipment and Systems

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed color 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 color coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Additional requirements: as specified in individual specification sections.

1.8 Maintenance Materials

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .5 Submit inventory listing to the Departmental Representative.
 - .6 Include approved listings in maintenance manual.
 - .7 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock Materials:
 - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .5 Submit inventory listing to the Departmental Representative.
 - .6 Include approved listings in maintenance manual.
 - .7 Obtain receipt for delivered products and submit prior to final payment.

- .3 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to location as directed by Departmental Representative; place and store.
 - .4 Receive and catalogue items.
 - .5 Submit inventory listing to the Departmental Representative.
 - .6 Include approved listings in maintenance manual.

1.9 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 the Departmental Representative.

1.10 Warranties and Bonds

- .1 Develop warranty management plan to contain information relevant to warranties.
- .2 Submit warranty management plan, 15 days before planned pre-warranty conference, to the Departmental Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that the 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 the 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 Departmental Representative permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 6 month warranty inspection, measured from time of acceptance, just prior to expiration 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 gates.
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .4 Name of item.
 - .5 Model and serial numbers.
 - .6 Location where installed.
 - .7 Name and phone numbers of manufacturers or suppliers.
 - .8 Names, addresses and telephone numbers of sources of spare parts.
 - .9 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .10 Cross-reference to warranty certificates as applicable.
 - .11 Starting point and duration of warranty period.
 - .12 Summary of maintenance procedures required to continue warranty in force.
 - .13 Cross-reference to specific pertinent operation and maintenance manuals.
 - .14 Organization, names and phone numbers of persons to call for warranty service.

- .15 Typical response time and repair time expected for various warranted equipment.
- .16 Contractor's plans for attendance at 6 month post-construction warranty inspections.
- .17 Procedure and status of tagging of equipment covered by extended warranties.
- .18 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 owner to proceed with action against contractor.

1.11 Warranty Tags

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water-resistant tag approved by the Departmental Representative.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

Part 2 Products

- .1 Not Used

Part 3 Execution

- .1 Not Used

END OF SECTION

Part 1 General

1.1 Manual

- .1 An organized compilation of operating and maintenance data including detailed technical information, documents and records describing operation and maintenance of individual products or systems as specified in individual sections of Divisions 02 - 40.

1.2 General

- .1 Assemble, coordinate, bind and index required data into Operation and Maintenance Manual.
- .2 Submit one copy of draft operation and maintenance manual to Departmental Representative fifteen (15) days prior to application for Interim Certificate of Completion of project.
- .3 Submit three (3) hardcopy sets of final manual in English, and in electronic (.pdf) format merged into a single file.
- .4 Material: label each section with tabs protected with celluloid covers fastened to hard paper dividing sheets.
- .5 Type lists and notes.
- .6 Drawings, diagrams and manufacturer's literature must be legible.

1.3 Binders

- .1 Prepare sets of manuals for various divisions using identical bindings, and the same indexing system and format for all manuals.
- .2 Provide 215 x 280 mm hard covered, three hole extension type catalogue binders with a 75 mm spine bound with heavy weight fabriccord, hot stamped in silver lettering front and spine. Acceptable Material: Universal Bindery. The Contractor shall be responsible for determining the required number and thickness of the binder(s) for each set.
- .3 Wording shall be prepared by the Contractor and submitted for approval to the Departmental Representative prior to embossing.
- .4 The number of binders shall be determined by the Contractor based on the amount of material submitted. To determine the required number of binders, the contents of each binder shall not be more than 75 mm thick.

1.4 Contents

- .1 The information to be included in the binder is as follows:
 - .1 Title sheet, labelled "Operations and Maintenance Instructions", containing project name and date.
 - .2 Table of contents.

- .3 List with names, addresses, telephone numbers of Contractor, Subcontractors, Manufacturers, Suppliers and Agents, Service Companies.
- .4 A master check list with operations, maintenance and lubrication tasks for all equipment in the facility organized into daily, weekly, monthly, bimonthly, biyearly categories.
- .5 Copies of all final Shop Drawings (review stamped).
- .6 Manufacturer's data sheets (operating and maintenance brochure) on all Equipment. Locate this information with the Shop Drawings for the same piece of equipment.
- .7 Installation and performance test data on all equipment including start-up and commissioning sheets from Section 01 91 31 Commissioning.
- .8 Reports and certificates of inspection including Electrical / Mechanical Inspection certificates.
- .9 Operations, maintenance and lubrication instructions, for each section, including daily, weekly, monthly, semi-annual and annual checks for equipment and systems, including complete list of equipment and tools.
- .10 Valve directory listing serial number, purpose, location, size, make, tag numbers as marked on the project record drawings and other pertinent information of each valve.
- .11 Operational information on all mechanical components.
- .12 Parts list for all Equipment.
- .13 Recommended spare parts list for each piece of Equipment.
- .14 Start-up reports prepared by manufacturer's Representatives.
- .15 List of maintenance tools supplied.
- .16 Calibration sheets for all instruments.
- .17 Regulatory inspection certificates.
- .2 Information shall be provided in the form of original Manufacturer's printed literature, supplemented by typed sheets when necessary. Originals are to be provided for all three manuals. Faxes or poor quality photocopies are not acceptable.

1.5 Documents by Departmental Representative

- .1 The Departmental Representative will insert reduced Record Drawings with changes submitted by the Contractor and a Description of Operation.
- .2 The Table of Contents shall identify that these documents are included in the Manual.

Part 2 Products

.1 Not used

Part 3 Execution

.1 Not Used

END OF SECTION

Part 1 General

1.1 Administrative Requirements

- .1 Demonstrate operation and maintenance of equipment and systems to Owner's personnel prior to date of substantial performance.
- .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 testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 – Facility Startup - Commissioning 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.
 - .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 First Completed Greenhouse: 4 Hours
 - .2 Each Subsequent Greenhouse: 1 Hour
 - .3 Upon Completion of Final Greenhouse: 1 Hour

1.2 Action and Informational Submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.

- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration, with list of persons present.
- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.3 Quality Assurance

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

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 Scope

- .1 Start-up and commissioning shall include all equipment installed under this Contract.

1.2 Liability

- .1 The Contractor shall take charge of facility during tests, assume responsibility for damages in event of injury to personnel, building or equipment and bear costs for liability, repairs and restoration in this connection.

1.3 Coordination

- .1 Coordinate start up and commissioning schedule with the Departmental Representative.
- .2 The Departmental Representative, at their discretion, may witness any or all commissioning activities performed on site, but they will not in any way lead the commissioning process or participate in operating the equipment.

Part 2 Products

- .1 The Contractor shall provide all materials required to complete commissioning.
- .2 The Contractor shall arrange for any temporary equipment and test equipment as required for commissioning activities. Include details of such equipment in the Commissioning Plan.

Part 3 Execution

3.1 Static Verification

- .1 Carry out static verification tests and submit completed test sheets to the Departmental Representative, including as applicable:
 - .1 Visual Inspection
 - .2 Continuity tests:
 - .1 Check each circuit for continuity and short circuits.
 - .2 Verify correct phase rotation and identify each phase conductor of each circuit.
 - .3 Check neutral and grounding connections.
 - .3 Insulation resistance tests:
 - .1 Megger circuits, feeders and equipment with operating voltages up to 208V with a 500V instrument.
 - .2 Megger circuits, feeders and equipment with operating voltages up to 600 V with a 1000V instrument.

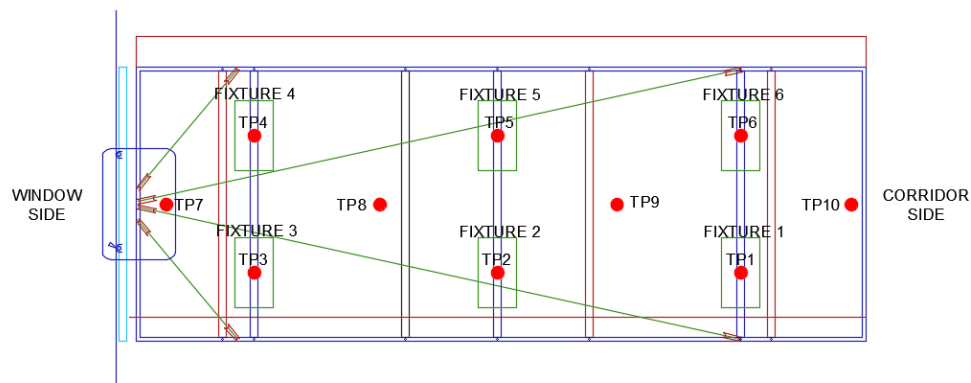
- .3 In all cases, ensure that resistance to ground is not less than required by code and manufacturer recommendations.
- .4 Verify correctness of connections and polarities of electrical supplies.
- .4 Control system I/O shall be loop checked for individual function and operation. Analog signals and set points shall be tested by means of signal injection from the field device and validation by calibrated test meters.
- .5 Implement settings for all programmable devices, monitoring instrument set-points and equipment communications systems.

3.2 Start-up

- .1 Arrange and pay for services of manufacturer's factory service technician to carry out start-up of installation, check, adjust, balance and calibrate components.

3.3 Functional Performance Testing

- .1 Arrange and pay for services of manufacturer's factory service technician to carry out functional performance testing of installation, in accordance with manufacturer drawings and manuals. Functional tests are to be overlapping, to ensure end-end functionality of the system.
- .2 Contractor is to supply test forms and procedures, and complete tests for each phase of commissioning. Sample forms are included within this Section. This form shall be updated as required by the Contractor to suit the system supplied.
- .3 Individual Bench Tests
 - .1 The test forms and tests performed shall include the following, as a minimum:
 - .1 Project Name and Owner
 - .2 Date and time of tests
 - .3 Greenhouse, compartment and bench under test
 - .4 Test instrument models and calibration data
 - .5 A bench supplemental light arrangement with a minimum of ten identified test points for use with tests described below.



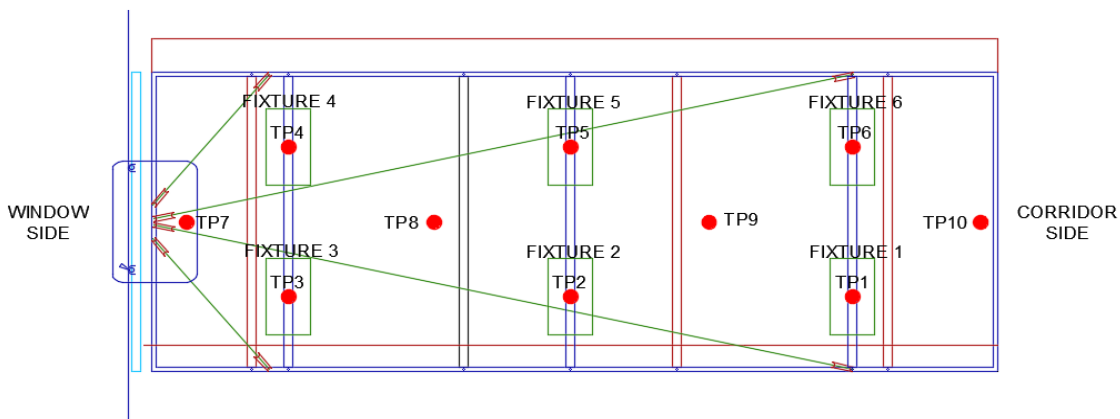
- .6 Light levels with all channels at 25%, 50%, 75% and 100% output, at plant canopy, with dark ambient conditions. Identify hangar height above plant canopy.
 - .7 Light levels with all channels at 25%, 50%, 75% and 100% output, at plant canopy, with full sun ambient conditions. Record ambient light. Identify hangar height above plant canopy
 - .8 Record electrical load (W, A) per bench with all channels at 100% output.
 - .9 Operate fixtures with control system configured for a DLI of 30. Record ambient readings and readings at plant canopy at two test points, at 30-minute intervals for an operating period of 16 hours. Take readings from installed PAR sensor for comparison. Calculate DLI for the operating period. Confirm control system operates to control the DLI with a tolerance of $\pm 5\%$.
 - .10 Adjust spectrum composition and plot an output wavelength / intensity graph for each of the following recipe combinations.
 - i. 60% R, 10% G, 30% B
 - ii. 75% R, 5% G, 15% B
 - iii. 90 % R, 0% G, 10% B
 - .11 Operate each feature of the control system application for each bench and confirm satisfactory operation.
- .4 Individual Greenhouse Tests
- .1 The test forms and tests performed shall include the following, as a minimum:
 - .1 Record electrical load (W, A) with all canopies at 100% output.
 - .2 Record total harmonic distortion at line side of each panel with all canopies at 100% output.

- .3 Record power factor for panel with all canopies at 100% output.
 - .4 Measure phase voltage of each panelboard with all lighting loads operating at time of acceptance. Determine voltage drops at loads and adjust transformer taps as required.
 - .5 Confirm access control of web based control system application for users identified at time of commissioning.
- .5 Complete System Tests
- .1 The test forms and tests performed shall include the following, as a minimum:
 - .1 Record electrical load (W, A) with all canopies at 100% output.
 - .2 Record total harmonic distortion at two identified points of common coupling associated with the combined system load.
 - .3 Record power factor for the system for all canopies at 100% output.
 - .6 Carry out further commissioning tests as recommended by equipment manufacturer literature.

3.4 Takeover Procedures

- .1 When the commissioning has been completed to the satisfaction of the Departmental Representative, the system shall be handed over for operation by the Owner.
- .2 A Warranty Period shall be in effect for one year starting from the date of the Interim Certificate of Completion. The expiry of the 12 month period does not relieve the Contractor of the responsibility to rectify any defect or fault which is observed prior to the expiry of the Warranty Period.

PROJECT NAME:	GREENHOUSE LED RETROFIT
OWNER	AGRICULTURE AND AGRI-FOOD CANADA
BENCH #	

[illegible]

SAMPLE PERFORMANCE TEST FORM – INDIVIDUAL BENCH (CONTINUED)

BENCH # ____

LIGHT LEVELS IN FULL SUN AMBIENT CONDITIONS ($\mu\text{mol} / \text{s} / \text{m}^2$)										
DATE AND TIME OF TESTS:										
HANGAR HEIGHT ABOVE PLANT CANOPY;										
AMBIENT LIGHT LEVEL:										
TEST POINT	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10
25% OUTPUT										
50% OUTPUT										
75% OUTPUT										
100% OUTPUT										

BENCH POWER	
DATE AND TIME OF TESTS:	
CURRENT (A) AT 100% INTENSITY	
POWER (W) AT 100% INTENSITY	

SAMPLE PERFORMANCE TEST FORM – INDIVIDUAL BENCH (CONTINUED)

BENCH # ____

CONTROLS TESTS	
DATE AND TIME OF TESTS:	
BENCH MAPPED IN APP	
USER SET-POINTS OPERATIONAL	
STATUS / READINGS CONSISTENT WITH MEASURED DATA	
WHITE VIEW MODE OPERATIONAL	
MANUAL MODE OPERATIONAL	
SPECTRUM COMPOSITION GRAPHS ATTACHED	

[illegible]

BENCH # _____

[illegible]

SAMPLE PERFORMANCE TEST FORM – INDIVIDUAL BENCH (CONTINUED)

BENCH # ____

TEST INSTRUMENT: _____

CALIBRATION DATA: _____

We certify that the system has been operated and tested as per the Specifications and that the System meets its Performance Testing Criteria, including fully automatic controls. The System is therefore classed as "conforming".

(Authorized Signing Representative of the Supplier) Date

(Authorized Signing Representative of the Contractor) Date

(Authorized Signing Representative of the Departmental Representative) Date

SAMPLE PERFORMANCE TEST FORM – GREENHOUSE

PROJECT NAME: GREENHOUSE LED RETROFIT

OWNER AGRICULTURE AND AGRI-FOOD CANADA

GREENHOUSE _____

GREENHOUSE POWER	
DATE AND TIME OF TESTS:	
CURRENT (A) AT 100% INTENSITY OF ALL CANOPIES POWER (W) AT 100% INTENSITY OF ALL CANOPIES THD AT GREENHOUSE PANEL AT 100% INTENSITY OF ALL CANOPIES POWER FACTOR AT GREENHOUSE PANEL AT 100% INTENSITY OF ALL CANOPIES VOLTAGE AT PANELBOARD (V) WORST-CASE VOLTAGE DROP (%)	

We certify that the system has been operated and tested as per the Specifications and that the System meets its Performance Testing Criteria, including fully automatic controls. The System is therefore classed as "conforming".

(Authorized Signing Representative of the Supplier) _____
Date

(Authorized Signing Representative of the Contractor) _____
Date

(Authorized Signing Representative of the Departmental Representative) _____
Date

SAMPLE PERFORMANCE TEST FORM – COMPLETE SYSTEM

PROJECT NAME: GREENHOUSE LED RETROFIT

OWNER AGRICULTURE AND AGRI-FOOD CANADA

COMPLETE LED LIGHTING POWER		
DATE AND TIME OF TESTS:		
PANELBOARD LOCATION	GNP1	GNP2
CURRENT (A) AT 100% INTENSITY OF ALL CANOPIES		
POWER (W) AT 100% INTENSITY OF ALL CANOPIES		
THD AT GREENHOUSE PANEL AT 100% INTENSITY OF ALL CANOPIES		
POWER FACTOR AT GREENHOUSE PANEL AT 100% INTENSITY OF ALL CANOPIES		
VOLTAGE AT PANELBOARD (V)		

We certify that the system has been operated and tested as per the Specifications and that the System meets its Performance Testing Criteria, including fully automatic controls. The System is therefore classed as "conforming".

(Authorized Signing Representative of the Supplier)

Date

(Authorized Signing Representative of the Contractor)

Date

(Authorized Signing Representative of the Departmental Representative)

Date

END OF SECTION

Part 1 General

- .1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.

1.1 General

- .1 Provide a fully functional system:
 - .1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
 - .2 Departmental Representative has been fully trained in aspects of installed systems.
 - .3 Optimized life cycle costs.
 - .4 Complete documentation relating to installed equipment and systems.
- .2 Term "Cx" in this section means "Commissioning".
- .3 Use this Cx Plan as master planning document for Cx:
 - .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
 - .2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
 - .3 Sets out deliverables relating to O&M, process and administration of Cx.
 - .4 Describes process of verification of how built works meet design requirements.
 - .5 Produces a complete functional system prior to issuance of Certificate of Occupancy.
 - .6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:
 - .1 Overview of Cx.
 - .2 General description of elements that make up Cx Plan.
 - .3 Process and methodology for successful Cx.
- .4 Acronyms:
 - .1 Cx - Commissioning.
 - .2 BMM - Building Management Manual.
 - .3 EMCS - Energy Monitoring and Control Systems.

- .4 MSDS - Material Safety Data Sheets.
- .5 PI - Product Information.
- .6 PV - Performance Verification.
- .7 TAB - Testing, Adjusting and Balancing.
- .8 WHMIS - Workplace Hazardous Materials Information System.
- .5 Commissioning terms used in this Section:
 - .1 Bumping: short term start-up to prove ability to start and prove correct rotation.
 - .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.2 Development of Cx Plan

- .1 The Contractor shall submit a Commissioning Plan, which will be reviewed by the Departmental representative in advance of site installation and commissioning activities.
- .2 The Commissioning Plan shall incorporate sections of CSA Z320 that are applicable to the system supplied under this contract, and cover as a minimum:
 - .1 Commissioning objectives
 - .2 Commissioning team, roles and responsibilities
 - .3 Schedule
 - .4 Static Verification
 - .5 Start-up
 - .6 Functional performance testing
 - .7 Training
 - .8 Documentation
 - .9 Final acceptance
- .3 Cx Plan to be 100% completed prior to installation of new equipment, and shall take into account:
 - .1 Approved shop drawings and product data.
 - .2 Approved changes to contract.
 - .3 Contractor's project schedule.

- .4 Cx schedule.
- .5 Contractor's, sub-contractor's, suppliers' requirements.
- .6 Project construction team's and Cx team's requirements.
- .4 Submit completed Cx Plan to Departmental Representative and obtain written approval.

1.3 Refinement of Cx Plan

- .1 The commissioning plan shall be updated by the Contractor to address Departmental representative comments, and progress, prior to each contract progress meeting.
- .2 During construction phase, revise, refine and update Cx Plan to include:
 - .1 Changes resulting from Client program modifications.
 - .2 Approved design and construction changes.
- .3 Revise, refine and update as required by the Departmental Representative during construction phase. At each revision, indicate revision number and date.
- .4 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.
- .5 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.4 Composition, Roles and Responsibilities of Cx Team

- .1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.
- .2 Project Manager will select Cx Team consisting of following members:
 - .1 PSPC Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
 - .2 PSPC Quality Assurance Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:
 - .1 Review of Cx documentation from operational perspective.
 - .2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
 - .3 Protection of health, safety and comfort of occupants and O&M personnel.
 - .4 Monitoring of Cx activities, training, development of Cx documentation.
 - .5 Work closely with members of Cx Team.

- .3 Departmental Representative is responsible for:
 - .1 Witnessing, certifying accuracy of reported results.
- .4 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with Contract Documents, including:
 - .1 Developing commissioning plan
 - .2 Organizing Cx.
 - .3 Monitoring operations Cx activities.
 - .4 Performing testing of installed systems and equipment.
 - .5 Certifying test results. Preparation, submission of test reports.
 - .6 Ensuring implementation of final Cx Plan.
 - .7 Implementation of Training Plan.
 - .8 Delivery of training and Cx documentation.
 - .9 Developing operation and maintenance manual.
 - .10 Assigning one person as point of contact with Departmental Representative for administrative and coordination purposes.

1.5 Cx Participants

- .1 Employ the following Cx participants to verify performance of equipment and systems:
 - .1 Installation contractor/subcontractor:
 - .1 Equipment and systems except as noted.
 - .2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.
 - .1 To include performance verification.
 - .3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.
 - .4 Ensure that Cx participant:
 - .1 Could complete work within scheduled time frame.
 - .2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel.

- .5 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx prior to starting date of Cx for review and approval.

1.6 Deliverables Relating to O&M Perspectives

- .1 General requirements:
 - .1 Compile English documentation.
 - .2 Documentation to be computer-compatible format ready for inputting for data management.
- .2 Provide deliverables:
 - .1 Warranties.
 - .2 Project record documentation.
 - .3 Inventory of spare parts, special tools and maintenance materials.
 - .4 Maintenance Management System (MMS) identification system used.
 - .5 WHMIS information.
 - .6 MSDS data sheets.
 - .7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

1.7 Deliverables Relating To The Cx Process

- .1 General:
 - .1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.
- .2 Definitions:
 - .1 Cx as used in this section includes:
 - .1 Cx of components, equipment, systems, subsystems, and integrated systems.
 - .2 Factory inspections and performance verification tests.
- .3 Deliverables: provide:
 - .1 Cx Specifications.
 - .2 Startup, pre-Cx activities and documentation for systems, and equipment.
 - .3 Completed installation checklists (ICL).

- .4 Completed product information (PI) report forms.
- .5 Completed performance verification (PV) report forms.
- .6 Results of Performance Verification Tests and Inspections.
- .7 Description of Cx activities and documentation.
- .8 Description of Cx of integrated systems and documentation.
- .9 Training Plans.
- .10 Cx Reports.
- .11 Prescribed activities during warranty period.
- .4 Departmental Representative to witness tests and reports of results by Contractor.

1.8 Pre-Cx Activities and Related Documentation

- .1 Items listed in this Cx Plan include the following:
 - .1 Pre-Start-Up inspections: by Departmental Representative prior to permission to start up and rectification of deficiencies to Departmental Representative's satisfaction.
 - .2 Departmental Representative to use approved check lists.
 - .3 Departmental Representative will monitor pre-start-up inspections.
 - .4 Include completed documentation with Cx report.

1.9 Start-Up

- .1 Start-up components, equipment and systems.
- .2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction, equipment, systems.
- .3 Departmental Representative to monitor these start-up activities.
 - .1 Rectify start-up deficiencies to satisfaction of Departmental Representative.
- .4 Performance Verification (PV):
 - .1 Approved Cx Agent to perform.
 - .1 Repeat when necessary until results are acceptable to Departmental Representative.
 - .2 Use procedures modified generic procedures to suit project requirements.

- .3 Departmental Representative to approve completed PV reports.

1.10 Cx Activities and Related Documentation

- .1 Departmental Representative to monitor Cx activities.
- .2 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.
- .3 Departmental Representative to witness Cx activities.

1.11 Cx of Integrated Systems and Related Documentation

- .1 Tests to be witnessed by Departmental Representative.
- .2 Upon satisfactory completion, Cx specialist to prepare Cx Report and submit to Departmental Representative for review.
- .3 Identification:
 - .1 In later stages of Cx, before hand-over and acceptance Departmental Representative and Cx Manager to co-operate to complete inventory data sheets and provide assistance in implementation of MMS identification system of components, equipment, sub-systems, systems.

1.12 Installation Check Lists (ICL))

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI)/Performance Verification (PV) Forms.

1.13 Product Information (PI) Report Forms

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI)/Performance Verification (PV) Forms.

1.14 Performance Verification (PV) Reports

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI)/Performance Verification (PV) Forms.

1.15 Cx Schedules

- .1 Prepare detailed Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:
 - .1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:
 - .1 Design criteria, design intents.
 - .2 Pre-TAB review: 28 days after contract award, and before construction starts.

- .3 Cx agents' credentials: 30 days before start of Cx.
- .4 Cx procedures: 30 days before start of Cx.
- .5 Cx Report format: 30 days before start of Cx.
- .6 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.
- .7 Notification of intention to start Cx: 14 days before start of Cx.
- .8 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.
- .9 Identification of deferred Cx.
- .10 Implementation of training plans.
- .11 Cx reports: immediately upon successful completion of Cx.
- .2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Departmental Representative.
- .2 After approval, incorporate Cx Schedule into Construction Schedule.
- .3 Departmental Representative will monitor progress of Cx against this schedule.
- 1.16 Cx Reports**
 - .1 Include completed and certified PV reports in properly formatted Cx Reports.
 - .2 Before reports are accepted, reported results to be subject to verification by Departmental Representative.
- 1.17 Final Settings**
 - .1 Upon completion of Cx to satisfaction of Departmental Representative, lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.
- Part 2 Products**
 - .1 Not Used.
- Part 3 Execution**
 - .1 Not Used.

END OF SECTION

Part 1 General

- .1 Commissioning forms to be completed for equipment, system and integrated system.

1.2 Installation/Start-Up Check Lists

- .1 Include the following data:
 - .1 Product manufacturer's installation instructions and recommended checks.
 - .2 Special procedures as specified in relevant technical sections.
 - .3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.
- .2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative, supplemental forms or additional data will be required for specific project conditions.
- .3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.
- .4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in operation and maintenance manual at completion of project.
- .5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 Product Information (PI) Report Forms

- .1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the operation and maintenance manual at completion of work.
- .2 Prior to Performance Verification (PV) of systems, complete items on PI forms related to systems and obtain Departmental Representative's approval.

1.4 Performance Verification (PV) Forms

- .1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.
- .2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

- .3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative's approval.

1.5 Samples of Commissioning Forms

- .1 Sample commissioning forms with minimum required data are included in Section 01 91 13.
- .2 Revise items on Commissioning forms to suit project requirements.

1.6 Changes and Development of New Report Forms

- .1 When additional forms are required, but are not provided in Section 01 91 13, develop appropriate verification forms and submit to DCC Representative for approval prior to use.
 - .1 Additional commissioning forms to be in same format as provided by Section 01 91 13.

1.7 Commissioning Forms

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
 - .1 Section 01 91 13 provides sample Commissioning forms with Specification data included.
 - .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
 - .3 Confirm operation as per design criteria and intent.
 - .4 Identify variances between design and operation and reasons for variances.
 - .5 Verify operation in specified normal and emergency modes and under specified load conditions.
 - .6 Record analytical and substantiating data.
 - .7 Verify reported results.
 - .8 Form to bear signatures of recording technician and reviewed and signed off by Departmental Representative.
 - .9 Submit immediately after tests are performed.
 - .10 Reported results in true measured SI unit values.
 - .11 Provide Departmental Representative with originals of completed forms.
 - .12 Maintain copy on site during start-up, testing and commissioning period.

- .13 Forms to be both hard copy and electronic format with typed written results in operation and maintenance manual.

1.8 Language

- .1 English.

Part 2 Products

- .1 Not Used.

Part 3 Execution

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 Reference Standards

- .1 ASTM International
 - .1 ASTM A36/A36M, Standard Specification for Carbon Structural Steel
 - .2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
 - .3 ASTM A123/123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - .4 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs
- .2 CSA Group
 - .1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
 - .2 CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles
 - .3 CSA S16, Design of Steel Structures
 - .4 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding
 - .5 CSA W59, Welded Steel Construction (Metal Arc Welding)

1.2 Action and Informational Submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit shop drawings for review prior to fabrication.
 - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.3 Delivery, Storage and Handling

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:

.1 Store materials off the ground in accordance with manufacturer's recommendations in a clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 Materials

.1 Steel sections and plates: to CSA G40.20/G40.21, Grade 300W

.2 Welding materials: to CSA W59

.3 Welding electrodes: to CSA W48 Series

.4 Bolts and anchor bolts: to ASTM A307

2.2 Fabrication

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Exposed welds shall be continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 Finishes

.1 Galvanizing: hot dipped galvanizing with zinc coating of 600 g/m² to CSA G164.

Part 3 Execution

3.1 Examination

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts acceptable for metal fabrications installation in accordance with manufacturer's written instructions.

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 Erection - General

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

- .3 Provide suitable means of anchorage acceptable to Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Supply components for work by other trades in accordance with shop drawings and schedule.
- .6 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.3 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials in accordance with Section 01 74 19 - Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 Protection

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

Part 1 Scope

- .1 Division 26 work on this contract includes supply, installation and field verification of the equipment indicated by drawings and referenced by specification sections. Selective demolition of existing supplemental lighting systems.
- .2 Co-operate and coordinate with the requirements of other units of work specified in other sections.

Part 2 Site Investigation

- .1 Examine the site and local conditions affecting the work and be satisfied that the work under this division can be satisfactorily carried out in accordance with the plans and specifications without changes.
- .2 No allowances will be made nor extra paid for unanticipated expense required to complete the work through failure to make this examination.

Part 3 Construction Schedule

- .1 The Contractor shall provide a detailed schedule for review and approval by the Departmental Representative prior to mobilization.
- .2 Construction shall be staged such that not more than one greenhouse is out of service at any given time.
- .3 Each greenhouse has an allotted construction period of one week. Construction activities that do not interfere with greenhouse operations may take place outside of this one week allocation.
- .4 There shall be a minimum of one business day between completion of commissioning of one greenhouse and commencing construction in another, to allow for rotation of crops.

Part 4 Codes and Standards

- .1 Work shall be done in accordance with the regulations and requirements of CSA C22.1 including provincial amendments, Canadian Fire Underwriters' Association, the Inspection Authorities of Board or Department of Provincial, Municipal or Civic Authority or Utility company having jurisdiction and the latest issues of the National Building Code.
- .2 Work shall be done by qualified electrical tradesman with a Journeyman Electrician supervising or doing the work.
- .3 Abbreviations for electrical terms: to CSA Z85.
- .4 These drawings and specifications shall govern where they are more stringent than code requirements.

Part 5 Permits, Fees

- .1 Obtain and pay for all permits, licenses and certificates in force, required for the performance of the work.

- .2 Give required notices, and comply with local, provincial or federal laws, ordinances, rules, regulations, codes and orders relating to the work, which are or become in force during the performance of the work.
- .3 Submit to Electrical Inspection Department and Utility Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .4 Make reasonable changes and alterations required by the Inspection Authority without cost to the Owner.

Part 6 Drawings and Specifications

- .1 The drawings utilize standard symbols to indicate the general arrangement and location of fixtures, outlets, switches, panels, controls, etc.
- .2 The quantity and location of new supplemental light fixtures, sensors, instruments and control panels is indicative. The final arrangement is dependent on what a specific vendor requires to meet the performance specifications. The Contractor shall include any changes to accommodate the Vendor arrangement, without cost impact to the project.
- .3 The Departmental Representative reserves the right to change the location of any piece of equipment without extra payment therefore, providing only that the change is requested before installation and that the new location is within 3 m of the original location.

Part 7 Shop Drawings, Product Data, and Samples

- .1 Submit shop drawings and samples in accordance with Section 01 33 00.
- .2 Each submittal shall include the following information, as applicable.
 - .1 Project No., name and location
 - .2 Equipment Tag Number
 - .3 Equipment manufacturer and model number.
 - .4 Manufacturer's name and description of item
 - .5 Equipment capacity, duty and performance across the full operating range of the equipment including but not limited to:
 - .1 Voltages and voltage regulation
 - .2 Currents / ampacity
 - .3 Number of phases / wires
 - .4 Frequency and frequency regulation
 - .5 Power factor
 - .6 Harmonic content
 - .7 Temperature rise, thermal capacity, insulation class
 - .8 Efficiency

- .9 Sound levels
 - .10 Agency approval and certification
 - .11 Single line, schematic, wiring and interconnection diagrams
 - .12 Functional block diagrams, logic diagrams, process flow charts
 - .13 HMI screenshots
 - .14 Bills of materials
 - .15 Details of construction materials, enclosure types, weights and dimensions, cable entry locations, position and size of components, busbars, foundations, drilling and mounting details
 - .16 Panel layouts, internal equipment layouts
 - .17 Catalogue cut sheets showing pertinent physical and operation characteristics of internal components.
 - .18 Lighting illuminance plan of each location in pdf format referencing actual building layout and equipment locations
 - .19 Reports
 - .20 Spare parts lists
 - .21 Warranty, service and support information
- .3 Manufacturer shall not commence fabrication or material shall not be delivered to the site until Departmental Representative reviewed shop drawings and catalogue data is in the hands of the Contractor.
- .4 The above shop drawings are for inclusion in the Operating and Maintenance Manuals.
- Part 8 Operation and Maintenance Data**
- .1 Shall be submitted as per Division 1.
- Part 9 Record Drawings**
- .1 Record drawings shall be as per Division 1.
- .2 Updates shall include relocation of equipment, changes to size, type, rating and addition, deletion or modification of cabling system.
- Part 10 Unity of Manufacture**
- .1 Repetitive items in general classifications including fixtures, receptacles, cover plates, branch circuit panels, circuit breakers and control stations, etc., shall be of the same manufacture and type through the project.
- Part 11 Manufacturer's Instructions**
- .1 The Contractor shall be responsible for the correct installation and assembly of all items of equipment. Manufacturer's instructions shall be carefully read and rigidly adhered to in the installation.

- .2 Any damage resulting from failure to observe the manufacturer's instructions or as a result of proceeding with the work without complete knowledge of a particular component, will be the Contractor's responsibility. The contractor shall make good any loss or damage resulting from malpractice.

Part 12 Voltage Ratings

- .1 Nominal Operating Voltage: 120 V AC, tolerances per ANSI C84.1 range A for utilization voltage.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

Part 13 Materials and Equipment

- .1 Provide materials and equipment in accordance with this Section.
- .2 Equipment and material to be CSA certified, and manufactured to standard quoted.
- .3 Factory assemble control panels and component assemblies.

Part 14 Finishes

- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.
 - .2 Paint indoor switchgear and distribution enclosures light grey to ANSI-61.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean, prime, and paint exposed hangers, racks, fastenings to prevent rusting.
- .4 Existing equipment shall be touched-up or repainted as required to make a finished project.
- .5 Name plates shall be kept free of paint.
- .6 Panel backboards shall have one coat of primer paint and two coats of ASA-61 gray enamel.

Part 15 Operating Environment

- .1 The equipment and wiring methods used shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - .1 Greenhouse
 - .1 Ambient Temperature: 0°C to 40°C

- .2 Altitude: 500 meters above sea level
 - .3 Relative Humidity: 0 to 95%, condensing
 - .4 Equipment within greenhouse areas shall be NEMA 3, 4 or 4X.
 - .5 Wiring methods shall be suitable for wet locations. Conduit shall have corrosion resistant coatings per conduit specification section.
- .2 Crawlspace
- .1 Ambient Temperature: 0 °C to 40°C
 - .2 Altitude: 500 meters above sea level
 - .3 Relative Humidity: 0 to 95%, non-condensing
 - .4 Equipment within crawlspace areas shall be NEMA 3, 4 or 4X.
 - .5 Wiring methods shall be suitable for wet locations.
- .3 Electrical Rooms
- .1 Ambient Temperature: 10 °C to 30°C
 - .2 Altitude: 500 meters above sea level
 - .3 Relative Humidity: 0 to 95%, non-condensing
 - .4 Equipment within electrical rooms shall be NEMA 1.

Part 16 Equipment Identification

- .1 Identify electrical equipment with nameplates and labels as follows.
- .2 Nameplates:
 - .1 Laminated 3 mm thick plastic engraving sheet, black face, white core, mechanically attached unless specified otherwise.

Nameplate Sizes				
Size 1	10 x 50 mm	1 line	3 mm	high letters
Size 2	12 x 70 mm	1 line	5 mm	high letters
Size 3	12 x 70 mm	2 lines	3 mm	high letters
Size 4	20 x 90 mm	1 line	8 mm	high letters
Size 5	25 x 90 mm	2 lines	5 mm	high letters
Size 6	25 x 100 mm	1 line	12 mm	high letters
Size 7	25 x 100 mm	2 lines	6 mm	high letters

- .3 Nameplates as above, but showing white against red, shall be provided, as warning signs where rule 12-3036, and rule 36-006, Canadian Electrical Code applies.
- .4 Dymo or similar adhesive labels will not be accepted.
- .5 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture, and where possible, be consistent with wording of existing labels in the facility.

- .6 Identification to be English.
- .7 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .8 Existing electrical equipment such as breakers, load centres, lighting panels, lighting contactor boxes, telephone cabinet, light control panel shall have nameplates installed.

Part 17 Manufacturer's and CSA Labels

- .1 Visible and legible after equipment is installed.

Part 18 Warning Signs

- .1 Provide warning signs, as specified and/or to meet requirements of Inspection Department and Departmental Representative.
- .2 Use porcelain enamel signs, minimum 175 x 250 mm size.

Part 19 Field Quality Control

- .1 Complete installation checks, including those by manufacturers, in accordance with Division 1.
- .2 Complete startup and commissioning of equipment in accordance with Division 01.

Part 20 Cleaning

- .1 At time of final cleaning, clean lighting reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt.
- .2 The interior and exterior of enclosures and boxes shall be cleaned of dust, dirt, and loose material, and if possible, shall be vacuum cleaned. All fastening screw holes provided in boxes and enclosures shall have a fastening screw installed.

END OF SECTION

Part 1 General

- .1 The requirements for selective demolition and removal of electrical components and incidentals required to complete work are described in this Section.

1.1 Definitions

- .1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of light fixtures, conduit, junction boxes, cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.
- .3 Existing: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.
- .4 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.2 Action and Informational Submittals

- .1 Action Submittals: Provide in accordance with Section 01 33 00– Submittal Procedures before starting work of this Section:
- .1 Construction Waste Management Plan (CWM Plan): Submit plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 21–Waste Management and Disposal.
- .2 Landfill Records: Indicate receipt and acceptance of selective demolition waste and hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.3 Administrative Requirements

- .1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.

1.4 Site Conditions

- .1 Existing Hazardous Substances: Departmental Representative has performed a hazardous substances assessment and identified high pressure sodium and T5 fluorescent light fixtures requiring removal and disposal as follows:
- .1 Hazardous substances will be removed by Contractor and disposed of in accordance with regulations in force as a part of Contract.

- .2 Immediately notify Departmental Representative if materials suspected of containing hazardous substances are encountered and perform following activities:
 - .1 Refer to Section 01 41 00– Regulatory Requirements for directives associated with specific material types.
 - .2 Hazardous substances will be as defined in Hazardous Products Act.
 - .3 Stop work in area of suspected hazardous substances.
 - .4 Take preventative measures to limit users' and workers' exposure, provide barriers and other safety devices and do not disturb.
 - .5 Proceed only after written instructions have been received from Departmental representative.

Part 2 Products

2.1 Repair Materials

- .1 Electrical Repair Materials: Use only new materials, CSA or ULC labelled as appropriate and matching components remaining after work associated with components identified for removal or demolition are completed.
- .2 Firestopping Repair Materials: Use firestopping materials compatible with existing firestopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

Salvage and Debris Materials

- .3 Material Ownership: Demolished materials become Contractor property and will be removed from Project site.

Part 3 Execution

3.0 Preparation

- .1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:
 - .1 Prevent debris from blocking drainage inlets.
 - .2 Protect electrical and mechanical systems that will remain in operation.
- .2 Protection of Building Occupants: Sequence demolition work so that interference with use of the building by Owner and users is minimized and as follows:
 - .1 Prevent debris from endangering safe access to and egress from occupied buildings.

- .2 Notify Departmental representative and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

3.1 Execution

- .1 Disconnect electrical circuits and panel feeders; maintain electrical service and main distribution panel as is, ready for subsequent Work.
- .2 Remove existing supplemental light fixtures, electrical devices and equipment including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.
- .3 Perform demolition work in a neat and workmanlike manner:
 - .1 Remove tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.
 - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.
- .4 Place weatherproof blank cover plates on exterior outlet boxes remaining after demolition and removal activities.
- .5 Remove existing conduits, boxes, cabling and wiring associated with removed luminaires, electrical devices and equipment.
- .6 Grind off conduits and make flush with surface of concrete where conduits are cast into concrete; seal open ends of conduit with silicone sealant and leave in place.
- .7 Seal open ends of conduit with silicone sealant and leave in place where they are inaccessible or cannot be removed without damaging adjacent construction.

3.2 Closeout Activities

- .1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre)
- .2 Hazardous Substances Disposal: Arrange for disposal of hazardous substances in accordance with legal disposal site.

END OF SECTION

Part 1 General

1.1 Scope

- .1 This section covers work related to Section 26 05 00 for the provision of Wire and Cable.

1.2 Shop Drawings

- .1 Submit shop drawings and installation instructions in accordance with Section 01 33 00 and 26 05 00.

1.3 Delivery, Storage and Handling

- .1 Deliver Materials to the Jobsite in original factory packaging, labelled with manufacturer's name, address.
- .2 Divert unused metal Materials from landfill to metal recycling facility.
- .3 Disposal and recycling of existing wire as per local regulations.

1.4 Operation and Maintenance Data

- .1 Provide operation and maintenance data as specified in Division 1.

Part 2 Products

2.1 Materials

- .1 Armored Power Cable (TECK90)
 - .1 CSA Teck90 armored power cable 1000 V.
 - .2 Copper conductors, quantity and size as indicated, bonding conductor
 - .3 1000 V XLPE Insulation
 - .4 Aluminum Interlocked armor
 - .5 PVC Jacket
 - .6 Thomas & Betts Star-Teck connectors or approved equal
- .2 Armored Control Cable (AIA)
 - .1 CSA Teck90 armored control cable 600 V
 - .2 Copper conductors, quantity and size as indicated, bonding conductor
 - .3 600 V XLPE Insulation
 - .4 Aluminum Interlocked armor

- .5 PVC Jacket
- .6 Thomas & Betts Star-Teck connectors or approved equal.
- .3 Non-armored Power Cable (RW90)
 - .1 Multi-conductor, CSA tray cable, non-armored for installation in conduit as indicated.
 - .2 Copper conductors, size as indicated,
 - .3 600 V, 1000 V XLPE Insulation, as indicated
- .4 Armored Instrumentation Cable (ACIC)
 - .1 CSA ACIC multiconductor armored instrumentation cable.
 - .2 Copper conductors, quantity and size as indicated
 - .3 600 V XLPE Insulation
 - .4 Overall PVC Jacket
 - .5 Individual and overall shields, twisted pair #16 AWG
 - .6 Individual and overall shields, twisted triad #16 AWG
 - .7 Interlocked aluminum armor
 - .8 PVC Jacket
 - .9 Thomas & Betts Star-Teck connectors or approved equal.
- .1 Non-Armored Instrumentation Cable (ACIC)
 - .1 CSA ACIC multiconductor armored instrumentation cable.
 - .2 Copper conductors, quantity and size as indicated
 - .3 600 V XLPE Insulation
 - .4 Overall PVC Jacket
 - .5 Individual and overall shields, twisted pair #16 AWG
 - .6 Individual and overall shields, twisted triad #16 AWG
- .2 Ethernet Cables (Cat 6)
 - .1 Cat 6 cable for Ethernet connections to equipment as indicated.
 - .2 4 twisted pairs, 23AWG solid strand conductors.

- .3 600V insulation for 600V MCC Ethernet connections. 300V insulation for other Ethernet connections.
- .4 Interlocked aluminum armor
- .5 PVC jacket.
- .6 Thomas & Betts Star-Teck connectors or approved equal.
- .3 Fiber Cable
 - .1 62.5 / 125 micron multi-mode fiber-optic cable
 - .2 Fiber count: 6
 - .3 Suitable for 1G application
 - .4 Tight buffer configuration, with inner jacket, interlocking armor and outer jacket
 - .5 Approved Product
 - .1 Belden FiberExpress
 - .6 Provide SC connectors as required to terminate 50% of the cable.

2.2 Wire Gauge

- .1 Where conductor sizes are not indicated on drawings, cable to be sized and installed or current carrying equal to or greater than the breaker or fuse protecting the cable. Size conductors for maximum 3% voltage drop.

Part 3 Execution

3.1 Installation

- .1 Install non-armored cables in conduit systems in accordance with Section 26 05 34.
- .2 Secure armored cables to strut supports on walls and ceilings.
- .3 Install lugs, stress relief tubes, tapes and any other materials required for correct installation and termination in accordance with manufacturer instructions. All termination kits and accessories shall be the proper equipment for the intended cable as indicated by the cable manufacturer.
- .4 Cable bends shall be not less than manufacturer and CEC requirements.
- .5 Connect shield of instrument cable to ground at one end only, preferably in the control panel. Do not ground instrument with shield wire, instead run a bonding conductor in the conduit.
- .6 Identify cables with engraved stainless steel cable tags, on both ends of cables, tags per cable schedules.

- .7 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
 - .1 Maintain phase sequence and colour coding throughout.
 - .2 Colour code: to latest CSA C22.1.
 - .3 Use colour coded wires in communication cables, matched throughout system.
 - .4 Uniquely identify each control wire, using typed, heat shrink wire markers at each end.
- .8 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

END OF SECTION

Part 1 General

1.1 Scope

- .1 This section covers work related to Section 26 05 00 for the provision of Splitters, Junction Boxes, Pull Boxes and Cabinets.

1.2 Shop Drawings

- .1 Submit shop drawings and installation instructions in accordance with Section 01 33 00 and 26 05 00.

1.3 Operation and Maintenance Data

- .1 Provide operation and maintenance data as specified in Division 1.

Part 2 Products

2.1 Splitters

- .1 Splitters shall not be used in this installation.

2.2 Junction and Pull Boxes

- .1 Boxes with Columbex Green Guard coating, or approved equal, for all conduits run within greenhouses.
- .2 Galvanized steel boxes for all other locations, to suit conduit type and size.

Part 3 Execution

3.1 Junction Boxes, Pull Boxes and Cabinets Installation

- .1 Install junction boxes and pull boxes in inconspicuous but accessible locations.

3.2 Identification

- .1 Install size 2 identification labels indicating voltage and phase in accordance with Section 26 05 00.

END OF SECTION

Part 1 General

1.1 Scope

- .1 This section covers work related to Section 26 05 00 for the provision of Outlet Boxes, Conduit Boxes and Fittings.

1.2 Shop Drawings

- .1 Submit shop drawings and installation instructions in accordance with Section 01 33 00 and 26 05 00.

1.3 Operation and Maintenance Data

- .1 Provide operation and maintenance data as specified in Division 1.

Part 2 Products

2.1 Outlet and Conduit Boxes General

- .1 Size boxes in accordance with CSA C22.1, Section 12.
- .2 102 mm square or large outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Combination boxes with barriers where outlets for more than one system are grouped.
- .6 Boxes with Columbex Green Guard coating, or approved equal, for all conduits run within greenhouses.
- .7 Galvanized steel boxes for all other locations, to suit conduit type and size.

2.2 Fittings - General

- .1 Connectors with nylon insulated throats.
- .2 Knock out filters to prevent entry of foreign materials.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.
- .5 Fittings with Columbex Green Guard coating, or approved equal, for all conduits run within greenhouses.

Part 3 Execution

3.1 Installation

.1 Outlet Box

.1 Provide boxes where indicated and as required for:

.1 Splices

.2 Taps

.3 Wire pulling

.4 Equipment

.5 Device location

.2 Install boxes surface mounted, except where an existing surface mount box is being replaced.

.3 Except where otherwise indicated, install boxes for vertical mounting of devices.

.4 Support boxes independent from conduit.

.2 Pull and Junction Box

.1 Locate as required by Canadian Electrical Code.

.2 Support boxes independent from conduit.

.3 Location of Wall Outlet Boxes

.1 Outlets are indicated on Drawings schematically. Consider locations indicated as approximate. Verify locations prior to rough-in.

.2 Confirm size and location of Equipment supplied and installed under other Sections, prior to rough-in.

.1 Do not install boxes back to back. Allow a minimum 150 mm separation.

.3 Position boxes in masonry walls to suit masonry course lines.

.4 Except where otherwise indicated, mount boxes at following heights:

.1 Local switches: 1400 mm.

.2 Receptacles:

a) General: 1400 mm.

- b) Above counters: 150 mm.
- .3 Telephone outlets:
 - a) Wall mounted telephone: 1400 mm.
- .5 Measure mounting height from finished floor to centre line of device.
- .6 The Departmental Representative reserves the right to change location of outlets prior to installation with no change in Contract Price, provided that distance does not exceed 3 m from originally indicated location.

END OF SECTION

Part 1 General

1.1 Scope

- .1 This section covers work related to Section 16010 for the provision of Conduits, Conduit Fastenings and Conduit Fittings.

1.2 Shop Drawings

- .1 Submit shop drawings and installation instructions in accordance with Section 01 33 00 and 26 05 00.

1.3 Operation and Maintenance Data

- .1 Provide operation and maintenance data as specified in Division 1.

Part 2 Products

2.1 Conduits

- .1 Conduit size and material as indicated and according to CEC requirements. Minimum conduit size shall be 21mm.
 - .1 Rigid galvanized steel threaded conduit, or EMT conduit within in crawl space to match existing.
 - .2 Rigid steel conduit with Columbex Green Guard coating for all conduits run within greenhouses.
 - .3 Conduit for underground runs for interconnection between greenhouses shall be schedule 40 PVC.

2.2 Conduit Fastenings

- .1 One hole steel straps to secure surface conduits 53 mm and smaller. Two holes steel straps for conduits larger than 53 mm.

2.3 Conduit Fittings

- .1 Fittings for raceways for CSA C22.2 No. 18.
- .2 Fittings and bends manufactured for use with conduit specified.
- .3 Conduit fittings with Columbex Green Guard coating, or approved equal, for all conduits run within greenhouses.

Part 3 Execution

3.1 Installation

- .1 Conduit installation methods and materials shall match existing, except as required to meet code requirements.

- .2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .3 Conduits shall be surface mounted, unless otherwise indicated on the drawings or in this section.
- .4 Use liquid tight flexible non-metallic conduit for connection to instruments, motors, and HVAC equipment.
- .5 Install polypropylene fish cord in empty conduits.
- .6 Run ground wire in all conduits per CEC requirements.

3.2 Surface Conduits

- .1 Conduit is to be neatly installed parallel to building lines on channel supports.
- .2 Conduits shall have 1.5 m clearance (minimum) to infrared or gas fired heaters.
- .3 Group conduits wherever possible on surface channels.
- .4 Do not pass conduits through structural members except as indicated.
- .5 Position conduits so that the markings on the conduit are facing the wall and are not visible.
- .6 Where cables, cable tray or conduits pass through floors and walls to hazardous areas and through fire rated walls, sealing shall be by approved fire sealants.

3.3 Conduits in Poured Concrete

- .1 Utilize existing sleeves in poured concrete for additional conduits, as required.

END OF SECTION

Part 1 General

1.1 Scope

- .1 This section covers work related to Section 26 05 00 for the provision and configuration of Networked Lighting Controls.
- .2 Control system shall include all hardware and software to accomplish the requirements specified herein.

1.2 Shop Drawings

- .1 Submit shop drawings and installation instructions in accordance with Section 01 33 00 and 26 05 00.

1.3 Operation and Maintenance Data

- .1 Provide operation and maintenance data as specified in Division 1.

Part 2 Products

2.1 System Objectives

- .1 The control system shall be compatible with and offer user configurable control of greenhouse LED supplementary lighting fixtures and associated instrumentation supplied under this contract.
- .2 The control system shall have spare capacity for a minimum of 10% additional fixtures and instruments.
- .3 The control system shall allow operation in two modes:
 - .1 Automatic Mode
 - .1 The control system shall control the Daily Light Integral received at each plant canopy within the greenhouse compartments by way of wireless control of the output intensity of each individual fixture.
 - .2 The target DLI and the photoperiod shall be user adjustable set-points for each individual bench.
 - .3 DLI control units shall be Moles/m²/day. Set-point range shall be between 0 (OFF) and 50.
 - .4 The photoperiod shall be a user adjustable set-point for each individual bench. Set-point range shall be between 6 and 18 hours per day, with a user defined start time.
 - .5 The control system shall operate to control the DLI to the user set point, over the user set photoperiod, with a tolerance of ±5%. Light fixture output will be off when outside of the photoperiod.

- .6 The PAR sensor(s) associated with each light fixture shall be monitored wirelessly by the control system and used in the output intensity control of each fixture, to achieve a consistent DLI for the entire bench.
- .7 The spectrum composition shall be by user adjustable set-points, specific for each bench.
- .2 Manual Mode:
 - .1 The user may select intensity by operator set-point, displayed as a %, specific for each light fixture.
 - .2 The user may access white view mode by single button operation, specific for each bench.
 - .3 The spectrum composition shall be by user adjustable set-points, specific for each light fixture.

2.2 System Performance

- .1 The control system shall allow the light intensity output of each fixture to be individually adjustable in the range from 150 to 500 $\mu\text{mol/s/M}^2$ PAR (between 400 to 700 nm) at plant canopy, with the fixtures positioned at a distance of no less than 1000 mm above the plant canopy.
- .2 Light spectrum composition shall be fully adjustable:
 - .1 Across the PAR range of 400 nm to 700 nm
 - .2 To a specific wavelength
 - .3 To white color light viewing mode.

2.3 Configuration and Grouping

- .1 Control system shall allow wireless connection and addressing of individual LED light fixtures, PAR sensors and other instruments as required. Fixtures shall be tagged and identified in the control system as shown by drawings.
- .2 The control system shall be configured such that fixtures associated with each bench shall be arranged, named and viewed as a group.

2.4 Control Panels and Instruments

- .1 The control panels, associated components and instruments shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - .1 Ambient Temperature: 0°C to 40°C
 - .2 Altitude: 500 meters above sea level

- .3 Relative Humidity: 0 to 95%, condensing
- .2 Control panel enclosures shall be NEMA 3, 4 or 4X, located within the greenhouse corridor, at a height not to cause obstruction to greenhouse operations.
- .3 Power Supplies
 - .1 Panels shall be powered from a single 120 V receptacle. Internal power supplies and batteries shall be provided to achieve required controller memory and ability to ride through power outages.
- .4 A single, dedicated internet service connection will be provided by the Owner. The Contractor is responsible for interconnections between control panels and controlled devices as required.
- .5 Quantity and location of control panels shown by drawings is indicative. Vendor shall be responsible for determining quantity and location of panels in order to achieve reliable communications with all devices supplied under this contract. The Contractor shall include any changes to accommodate the Vendor arrangement, without cost impact to the project.
- .6 Where multiple control panels are used, all control panels used in the system shall be identical in manufacturer, model, functionality and configuration.
- .7 One existing control panel, installed as part of the Lumigrow pilot testing, shall be de-commissioned and turned over to the owner. This contract shall be fulfilled by use of entirely new equipment.

2.5 Warranties

- .1 Control system panels, instruments and component warranty of a minimum of three years from time of substantial completion.
- .2 Minimum of three years technical support and updates for software, applications and similar for all equipment.

2.6 Web Based Application

- .1 The control system shall include a web based application available on mobile devices as well as desktop PCs for configuration and monitoring of the lighting system.
- .2 One or more control stations may be used, but shall utilize a single internet service, which is existing, and be combined in a single application. The application shall include adequate security and firewalls to protect the system.
- .3 The application shall include real-time display of each supplemental light fixture performance, as well as configuration and set-point data.
- .4 Account Types
 - .1 There shall be a minimum of three different account types: 'View Only', 'Configuration' and 'Admin'.

- .2 The application shall allow an unlimited number of user accounts of each account type. Each account shall have a unique user name and password to control access.
 - .3 In view-only mode, it shall not be possible to make changes to programmed set-points, with the exception that 'White View Mode' may be configured for periods of up to 15 minutes.
 - .4 Configuration mode shall allow viewing and adjustment of any parameter or set-point.
 - .5 Admin mode is intended to manage the access permissions of users and create and delete accounts as appropriate. The process of creating and configuring an account type must be achievable within five minutes.
- .5 The following failure modes are expected. Vendors may propose alternate failure mode responses for review during the tender period.
- .1 Upon failure of the internet connection to the control system, or a part of the system, all fixtures shall hold the last settings for spectrum and intensity to revert to 100% on, for all color channels.
 - .2 Upon failure of the power to the control system, the system will retain all settings such that normal operation can resume when power is restored. Duration of power failure of 48 hours should be considered. There is no standby power for the facility. An alarm is to be generated on the 'Config' users screens and an email sent to the 'Admin' accounts.
 - .3 Communication failure with an individual fixture shall cause fixtures to hold the last settings for spectrum and intensity to revert to 100% on, for all color channels. An alarm to be generated on the 'Config' users' screens and an email sent to the 'Admin' accounts.
- .6 Application Screens
- .1 The description of screen layout is a guideline. Alternate proposals may be made during the tender period.
 - .2 The application HMI screens shall be organized as one screen per greenhouse. The screen shall list each compartment with:
 - .1 Accumulated DLI for the day, and the target DLI, or when in manual mode, a letter 'M' to indicate manual and the intensity setting.
 - .2 Spectrum recipe
 - .3 Ambient reading for the greenhouse
 - .3 Clicking on any compartment shall bring up a detailed status and configuration page, with navigation back to the greenhouse overview page. Detailed status includes:

- .1 Output intensity of each fixture
- .2 PAR sensor reading
- .3 Photoperiod controls
- .4 Spectrum controls for each color
- .5 Accumulated DLI for the day, and the target DLI,
- .6 Trending graph showing PAR sensor readings for the photoperiod
- .7 Automatic / Manual mode controls
- .4 Provide additional status summary screen including:
 - .1 Overall accumulated operating kWh and cost per day, with configurable cost per kWh
 - .5 Alarm conditions are shown on the greenhouse overview pages.
 - .6 Color scheme of screens shall allow simple identification of fixtures or greenhouses in alarm condition and those in manual mode.

Part 3 Execution

3.1 Installation

- .1 Locate and install control panels as indicated.
- .2 Configure wireless communications, HMI screens and instruments

END OF SECTION

Part 1 General

1.1 Scope

- .1 This section covers work related to Section 26 05 00 for the provision of Low Voltage Harmonic Filtering

1.2 Shop Drawings

- .1 Submit shop drawings and installation instructions in accordance with Section 01 33 00 and 26 05 00.

1.3 Delivery, Storage and Handling

- .1 Deliver Materials to the Jobsite in original factory packaging, labelled with manufacturer's name, address.

1.4 Operation and Maintenance Data

- .1 Provide operation and maintenance data as specified in Division 1.

Part 2 Products

2.1 Basic Requirements

- .1 Closed loop, digital FFT harmonic cancelation to meet IEEE 519 for harmonic limits apparent at reference busbar for operation on Utility power and standby generator:
- .2 Supply voltage: Rated for operation on 120 / 208 V, 3 phase 4 wire, 60 Hz systems.
 - .1 Equipment to be compatible with harmonics generated by single phase LED light fixtures as specified by other sections. LED light fixtures will be grouped and balanced between the three phases of the electrical system as far as practical, as indicated by drawings.
- .3 Output current rating of each unit: 60 A rms. The equipment output shall be self-limited, and compatible with a 80 A upstream circuit breaker.
- .4 Minimum continuous harmonic correction output is to be 108 A, after accounting for all applicable de-rating factors. Installation location has an ambient temperature of 35°C
- .5 Two identical units are required to operate in parallel to provide the overall harmonic correction. Each unit shall also be able to operate independently, should one unit be out of service.
- .6 Harmonic spectrum cancellation: 2nd to 51st
 - .1 Harmonic correction time: 2 cycles
 - .2 Resonance detection and avoidance
 - .3 Optimized power factor control to set-point of 0.95 lagging

- .4 Discrete outputs, configured as indicated
- .5 Color HMI
- .6 CSA certified
- .7 Enclosure: Wall mount, NEMA 1 enclosure.
- .7 Each unit to have reference CTs, to be installed upstream of main circuit breaker as indicated. One set of CTs are to be used to operate two filter units.
- .8 Approved Product:
 - .1 Square D Accusine PCSn
 - .2 Approved equal
- .9 Qualifications
 - .1 The Vendor is required to notify the Engineer 7 days prior to close of bids if an alternate rating and/or physical size than indicated is required to meet any of the defined operating duties.

2.2 Equipment Identification

- .1 Provide equipment identification in accordance with Section 16010 - Electrical General Provisions.

Part 3 Execution

3.1 Installation

- .1 Mount equipment where indicated on the drawings.
- .2 Ensure adequate clearance for ventilation.
- .3 Install in level upright position.
- .4 Make primary and secondary connections in accordance with wiring diagram.

3.2 Field Quality Control

- .1 Perform tests in accordance with Section 16010 – Electrical - General Requirements.

END OF SECTION

Part 1 General

1.1 Scope

- .1 This section covers work related to Section 26 05 00 for the provision of LED lighting fixtures.

1.2 Shop Drawings

- .1 Submit shop drawings and installation instructions in accordance with Section 01 33 00 and 26 05 00.
- .2 Submit a detailed lighting distribution plan for each bench type, showing min, max and average lighting levels, with zero ambient support, at heights above plant canopy in the range 1000 mm to 1500 mm. Indicate height(s) above plant canopy that meet the project requirements.

1.3 Delivery, Storage and Handling

- .1 Deliver Materials to the Jobsite in original factory packaging, labelled with manufacturer's name, address.
- .2 Divert unused metal Materials from landfill to metal recycling facility.
- .3 Disposal and recycling of existing lamps as per local regulations.

1.4 Operation and Maintenance Data

- .1 Provide operation and maintenance data as specified in Division 1.

Part 2 Products

2.1 Fixture Performance

- .1 Optical Performance
 - .1 Readily adjustable light fixtures (spectrum, intensity, and photoperiod), in conjunction with the lighting control system.
 - .2 Light intensity adjustable in the range from 150 to 500 $\mu\text{mol/s/M}^2$ PAR (between 400 to 700 nm) at plant canopy, with the fixtures positioned at a distance of no less than 1000 mm above the plant canopy.
 - .3 Light spectrum composition shall be fully adjustable:
 - .1 Across the PAR range of 400 nm to 700 nm
 - .2 To a specific wavelength
 - .3 To white color light viewing mode.

.2 Electrical Characteristics

- .1 Nominal Operating Voltage: 120 V AC, tolerances per ANSI C84.1 range A for utilization voltage.
- .2 Nominal Operating Frequency: 60 Hz, $\pm 10\%$
- .3 Power factor: > 0.90
- .4 Complete with 120 V NEMA 5-15P plug and 10' flexible cord.
- .5 Coefficient of utilization (CU0 to be a minimum of 1.9 $\mu\text{mol/J}$ (PPF/W)

.3 Controls Characteristics

- .1 Built-in wireless controls, compatible with control system per Section 26 09 43

.4 Mechanical Characteristics

- .1 The fixtures and associated instruments shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - .1 Ambient Temperature: 0°C to 40°C
 - .2 Altitude: 500 meters above sea level
 - .3 Relative Humidity: 0 to 95%, non-condensing
- .2 Suitable for mounting on hangar frame, with strut support locations as indicated. Configuration shall not require modification to strut locations.
- .3 Fixtures shall be IP 24 rated, minimum

.5 Certifications

- .1 RoHS compliance, mercury and lead-free
- .2 cUL or CSA certified
- .3 Fixtures that require field certification will not be permitted

.6 Warranties

- .1 Fixture and instrument warranty of a minimum of three years from time of substantial completion.
- .2 Light intensity depreciation according to IESNA (50,000 hours at L70) at 40 dg C
- .3 Minimum of three years technical support and updates for software, applications and similar for all equipment.

2.2 Canopy Performance

- .1 Fixtures shall be configured to achieve a Daily Light Integral of 30 Moles/m²/day at plant canopy, across the entire area of each bench, over a nominal 16 hour photoperiod. DLI is a combination of natural ambient light and the LED supplemental light fixtures.
- .2 Homogeneity minimum to average of 0.8 – 1.0 of light intensity, at any intensity selected, at the manufacturer recommended height above plant canopy.
- .3 Power required shall not exceed 1280 VA, or 10.6 A per phase, for a total of 3820 VA per bench, maximum. One three phase panelboard circuit per bench.
- .4 Heat rejection per canopy shall not exceed 15,000 BTU / hr
- .5 Fixture weight per bench shall not exceed 80 kg.

2.3 System Performance

- .1 Electrical Loading:
 - .1 Overall loading of the complete lighting system shall not exceed 320 kVA, or 900 A per phase.
 - .2 Loading shall be balanced between phases as far as practical.
 - .3 Loading on panel GNL1A shall not exceed 70 kVA, or 200 A per phase
 - .4 Loading on panel GNL1B shall not exceed 35 kVA, or 100 A per phase
 - .5 Loading on panel GNL2B shall not exceed 35 kVA, or 100 A per phase
 - .6 Loading on panel GNL1C shall not exceed 70 kVA, or 200 A per phase
 - .7 Loading on panel GNL1D shall not exceed 75 kVA, or 210 A per phase
 - .8 Loading on panel GNL1E shall not exceed 35 kVA, or 100 A per phase
 - .9 Operating power factor with all fixtures in operation at 100% power output shall be between 0.90 and 0.98 lagging.
- .2 Operating total harmonic current distortion (THDi) of the system shall be less than 17.1%, with all fixtures in operation at 100% power output, with the following reference points of common coupling:
 - .1 Line side of panel GNP1-120/208V-1200A, which serves all greenhouse lighting loads
 - .1 Operating THDi of not more than 130A per phase or neutral
 - .2 The lighting equipment supplier shall be responsible for all costs associated with branch circuit wiring and supply and installation of harmonic distortion correction

equipment where operating harmonic currents of the supplied equipment exceeds the values stated above.

2.4 Optical Control Devices

- .1 Provide a minimum of one (1) new PAR sensor for each supplemental light fixture, to send information to the supplemental growth light control system; PAR sensors shall be located to most closely reflect lighting levels at plant canopy, taking into account ambient light.

2.5 Design Basis

- .1 Pilot testing of LED fixtures has been carried out using LumiGrow Pro650e fixtures. However, use of these fixtures in pilot testing is not intended to grant approval, otherwise supersede performance requirements, or restrict the tendering process.
- .2 The six existing LED supplemental light fixtures, installed as part of the Lumigrow pilot testing, shall be de-commissioned and turned over to the owner. This contract shall be fulfilled by use of entirely new equipment.
- .3 Design drawings and specifications are based on using LumiGrow Toplight fixtures. The manufacturer, model, quantity and arrangement of fixtures shown may be modified from those shown by drawings, and is open for proposal by Vendors, providing the optical, electrical and mechanical performance requirements can be met.
- .4 The Contractor is responsible for ensuring that proposed systems will meet the performance requirements set out by the contract documents. The Contractor shall include any changes to accommodate the Vendor arrangement, without cost impact to the project.

2.6 Spares

- .1 Provide spare fixtures, complete with required control devices, not less than 2% of the total quantity installed for the project.

Part 3 Execution

3.1 Storage

- .1 Storage of fixtures and associated equipment is the responsibility of the Contractor. Fixtures may be stored on-site in a secure storage location per 01 52 00 and in accordance with manufacturer recommendations. All on-site storage to be coordinated with Departmental Representative.

3.2 Installation

- .1 Locate and install luminaires as required by Vendor to meet the performance requirements.

3.3 Wiring

- .1 Connect luminaires to lighting circuits as indicated
- .2 Coil and support flexible power supply cable, while allowing adjustment of height above plant canopy.

3.4 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 or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION