GENERAL REQUIREMENTS SPECIFICATIONS

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises general fit-out of an existing space on the 3rd floor of Metro Hall, for use as a Security Server Room, and is further identified as the Project.

1.2 CONTRACT METHOD

.1 Construct Work under stipulated price contract.

1.3 WORK BY OTHERS

.1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Consultant.

.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 Consultant, in writing, any defects which may interfere with proper execution of Work.

1.4 WORK SEQUENCE

.1 Construct Work in stages to accommodate Owner's continued use of existing premises during construction.

.2 Co-ordinate Progress Schedule during construction.

.3 Maintain fire access/control.

1.5 CONTRACTOR USE OF PREMISES

.1 Unrestricted use of site until Substantial Performance.

.2 Limit use of premises for Work, access, and storage,]to allow:

.1 Owner occupancy.

.2 Work by other contractors.

.3 Public usage.

.3 Co-ordinate use of premises under direction of Owner.

.4 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.5 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.6 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Consultant.

At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.6 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING FACILITIES

.1 Execute work with least possible interference or disturbance to occupants, building operations, public and normal use of premises. Arrange with Owner to facilitate execution of work.

1.7 EXISTING SERVICES

.1 Notify, Owner and Consultant of intended interruption of services and obtain required permission.

.2 Where Work involves intercepting or connecting to existing services, give Owner and Consultant 10 days' notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by Owner with minimum disturbance to operations.

.3 Provide alternative routes for personnel traffic.

.4 Establish location and extent of service lines in area of work before starting Work. Notify Owner and Consultant of findings.

.5 Submit schedule to and obtain approval from Owner and Consultant for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.

.6 Provide temporary services when directed by Owner and/or Consultant to maintain critical building and tenant systems.

.7 Where unknown services are encountered, immediately advise Owner and Consultant and confirm findings in writing.

.8 Protect, relocate, or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

.9 Record locations of maintained, re-routed, and abandoned service lines.

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

1.8 DOCUMENTS REQUIRED

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

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

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 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, ramps or ladders, and scaffolding, 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 the site. Make arrangements with Owner to facilitate work as stated.

.2 Maintain existing services to building and provide for personnel and vehicle access.

.3 Where security is reduced by work provide temporary means to maintain security.

.4 Owner will assign sanitary facilities for use by Contractor's personnel, or direct that the Contractor provide its own on-site facilities. Keep facilities clean.

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

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

.1 Execute work with least possible interference or disturbance to building and site operations, and the occupants. Arrange with Owner to facilitate execution of work.

1.4 EXISTING SERVICES

.1 Notify the Owner and Consultant of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give the Owner and Consultant ten (10) days' notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.

.3 Provide for pedestrian traffic.

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

1.5 SPECIAL REQUIREMENTS

.1 Submit schedule in accordance with Section 01 32 16.07 - Construction Progress Schedule

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

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

.4 Ingress and egress of Contractor vehicles at site is limited to the driveway designated by Owner.

.5 Deliver materials outside of peak traffic hours unless otherwise approved by Owner.

1.6 SECURITY

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

.2 Security clearances:

.1 Personnel employed on this project will be subject to security check. Obtain clearance, as instructed, for everyone who will require to enter premises.

.2 Contractor's personnel will require satisfactory security screening by an agency designated by the Owner to complete Work in premises and on site.

1.7 BUILDING SMOKING ENVIRONMENT

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

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC), CCDC 2-2008, Stipulated Price Contract.

.2 Project Supplementary Conditions

1.2 CASH ALLOWANCES

.1 SPEC NOTE: If a Supplementary Condition has been written to delete the requirements of CCDC 2, GC 4.1, edit the following paragraphs to suit project and contract agreement.

.2 Refer to CCDC 2, GC 4.1.

.3 SPEC NOTE: If a Supplementary Condition has been written to delete the requirements of CCDC 2, GC 4.1, use the following four paragraphs.

.4 Include in Contract Price specified cash allowances.

.5 Cash allowances, unless otherwise specified, cover net cost to Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage installation and other authorized expenses incurred in performing Work.

.6 Contract Price, and not cash allowance, includes Contractor's overhead and profit in connection with such cash allowance.

.7 Contract Price will be adjusted by written order to provide for excess or deficit to each cash allowance.

.8 SPEC NOTE: If overhead and profit to the Contract are determined by means not identified in the Contract Documents, edit the following paragraph to suit conditions accordingly.

.9 Where costs under a cash allowance exceed amount of allowance, Contractor will be compensated for excess incurred and substantiated plus allowance for overhead and profit as set out in Contract Documents.

.10 Include progress payments on accounts of work authorized under cash allowances in Consultant's monthly certificate for payment.

.11 Prepare schedule jointly with Consultant to show when items called for under cash allowances must be authorized for ordering purposes so that progress of Work will not be delayed.

1.3 CONTINGENCY ALLOWANCE

.1 Refer to CCDC 2, GC 4.2.

.2 Include in Contract Price specified contingency allowance.

.3 Do not include in Contract Price, additional contingency allowances for products, installation, overhead or profit

.4 Expenditures under contingency allowance will be authorized in accordance with procedures provided in CCDC 2, GC 6.1 - Changes CCDC 2, 6.2 Change Order and CCDC 2, 6.3 Change Directive.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC), CCDC 23 - A Guide to Calling Bids and Awarding Contracts.

1.2 REQUIREMENTS

.1 Referenced specification Sections stipulate pertinent requirements for products and methods to achieve Work stipulated under each Alternative.

.2 Co-ordinate affected related Work and modified surrounding Work to integrate Work under each Alternative.

1.3 AWARD/SELECTION OF ALTERNATIVES

.1 Indicate variation of Bid Price for Alternatives listed in Bid Form. Note that this form requests a 'difference' in Bid. Price by adding to or deducting from base Bid price.

.2 Bids will be evaluated on 'Base Bid' price. After determination of lowest Bidder, consideration will be given to Alternatives and Bid Price adjustments.

.3 In accordance with CCDC Document No. 23 - A Guide to Calling Bids and Awarding Contracts, low Bid will be determined on basis of lowest Bid in accordance with Contract Documents on which Project is to be actually constructed, including those alternatives for which prices have been invited and which are to be incorporated in Work.

1.4 ALTERNATIVES

.1 Base Bid: generator and switchgear using dead field/start-up synchronization

.2 Alternative: generator and switchgear using conventional synchronization controls for paralleling

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 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC), CCDC 2-2008, Stipulated Price Contract.

1.2 APPLICATIONS FOR PROGRESS PAYMENT

.1 Refer to CCDC 2.

.2 Make applications for payment on account monthly as Work progresses.

.3 Date applications for payment last day of agreed monthly payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work at that date.

.4 Submit to Consultant, at least 14 days before first application for payment. Schedule of Values for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of applications for payment.

1.3 SCHEDULE OF VALUES

.1 Refer to CCDC 2

.2 Provide schedule of values supported by evidence as Consultant may reasonably direct and when accepted by Consultant, be used as basis for applications for payment.

.3 Include statement based on schedule of values with each application for payment.

.4 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Consultant may reasonably require to establish value and delivery of products.

1.4 PREPARING SCHEDULE OF UNIT PRICE TABLE ITEMS

.1 Submit separate schedule of unit price items of Work requested in [Bid] form.

.2 Make form of submittal parallel to Schedule of Values, with each line item identified same as line item in Schedule of Values. Include in unit prices only:

.1 Cost of material.

.2 Delivery and unloading at site.

.3 Sales taxes.

.4 Installation, overhead and profit.

.3 Ensure unit prices multiplied by quantities given equal material cost of that item in Schedule of Values.

1.5 PROGRESS PAYMENT

.1 Refer to CCDC 2.

.2 Consultant will issue to Owner, no later than 10 days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as Consultant determines to be due. If Consultant amends application, Consultant will give notification in writing giving reasons for amendment.

1.6 SUBSTANTIAL PERFORMANCE OF WORK

.1 Refer to CCDC 2.

.2 Prepare and submit to Consultant] comprehensive list of items to be completed or corrected and apply for a review by Consultant to establish Substantial Performance of Work. Failure to include items on list does not alter responsibility to complete Contract.

.3 No later than 10 days after receipt of list and application, Consultant will review Work to verify validity of application, and no later than 7 days after completing review, will notify Contractor if Work or designated portion of Work is substantially performed.

.4 Consultant: state date of Substantial Performance of Work or designated portion of Work in certificate.

.5 Immediately following issuance of certificate of Substantial Performance of Work, in consultation with Consultant, establish reasonable date for finishing Work.

1.7 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF WORK

.1 Refer to CCDC 2.

.2 After issuance of certificate of Substantial Performance of Work:

.1 Submit application for payment of holdback amount.

.2 Submit sworn statement that accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of Work and for which Owner might in be held responsible have been paid in full, except for amounts properly retained as holdback or as identified amount in dispute.

.3 After receipt of application for payment and sworn statement, Consultant will issue certificate for payment of holdback amount.

.4 Where holdback amount has not been placed in a separate holdback account, Owner shall, 10 days prior to expiry of holdback period stipulated in lien legislation applicable to Place of Work, place holdback amount in bank account in joint names of Owner and Contractor.

.5 Amount authorized by certificate for payment of holdback amount is due and payable on day following expiration of holdback period stipulated in lien legislation applicable to Place of Work. Where lien legislation does not exist or apply, holdback amount is due and payable in accordance with other legislation, industry practice, or provisions which may be agreed to between parties. Owner may retain out of holdback amount sums required by law to satisfy liens against Work or, if permitted by lien legislation applicable to Place of Work, other third party monetary claims against Contractor which are enforceable against Owner.

1.8 PROGRESSIVE RELEASE OF HOLDBACK

.1 Refer to CCDC 2.

.2 Where legislation permits, if Consultant has certified that Work of subcontractor or supplier has been performed prior to Substantial Performance of Work, Owner shall pay holdback amount retained for such subcontract Work, or products supplied by such supplier, on day following expiration of holdback period for such Work stipulated in lien legislation applicable to Place of Work.

.3 In addition to provisions of preceding paragraph, and certificate wording, ensure that such subcontract Work or products is protected pending issuance of final certificate for payment and be responsible for correction of defects or Work not performed regardless of whether or not such was apparent when such certificates were issued.

1.9 FINAL PAYMENT

.1 Refer to CCDC 2, GC 5.7.

.2 Submit application for final payment when Work is completed.

.3 Consultant] will, no later than 10 days after receipt of application for final payment, review Work to verify validity of application. Consultant will give notification that application is valid or give reasons why it is not valid, no later than 7 days after reviewing Work.

.4 Consultant will issue final certificate for payment when application for final payment is found valid.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 APPOINTMENT AND PAYMENT

.1 Owner, at Consultant's recommendation, will appoint and pay for services of testing laboratory except as follows:

.1 Inspection and testing required by laws, ordinances, rules, regulations, or orders of public authorities.

.2 Inspection and testing performed exclusively for Contractor's convenience.

.3 Testing, adjustment and balancing of mechanical and electrical equipment, and systems.

.4 Tests specified to be carried out by Contractor under the supervision of Consultant

.2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Consultant to verify acceptability of corrected work.

1.2 CONTRACTOR'S RESPONSIBILITIES

.1 Provide labour, equipment, and facilities to:

.1 Provide access to Work for inspection and testing.

.2 Facilitate inspections and tests.

.3 Make good Work disturbed by inspection and test.

.4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.

.2 Notify Owner or Consultant sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.

.3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

.4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Consultant.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE

.1 Schedule and administer project meetings throughout the progress of the work

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting four days in advance of meeting date to Consultant and Owner.

.4 Provide physical space and make arrangements for meetings.

.5 Preside at meetings.

.6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.

.7 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants and affected parties not in attendance.

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

1.2 PRECONSTRUCTION MEETING

.1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Owner, Consultant, Contractor, major Subcontractors, field inspectors and supervisors shall be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.

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

.5 Agenda to include:

.1 Appointment of official representative of participants in the Work.

.2 Schedule of Work: in accordance with Section 01 32 16.- Construction Progress Schedules - Bar (GANTT) Chart

.3 Schedule of submission of shop drawings. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.

.4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.

.5 Delivery schedule of specified equipment.

.6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

.7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.

.8 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.

.9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.

.10 Take-over procedures, acceptance, warranties in accordance with Section [01 78 00 - Closeout Submittals.

.11 Monthly progress claims, administrative procedures, photographs, hold backs.

.12 Appointment of inspection and testing agencies or firms.

.13 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

.1 Schedule monthly progress meetings during the course of Work

.2 Contractor, major Subcontractors involved in Work, Consultant and Owner shall be in attendance.

.3 Notify parties minimum 5 days prior to meetings.

.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.

.5 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for effect on construction schedule and on completion date.

.12 Other business

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED.

END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE

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

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

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

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

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

.6 Notify Consultant and Owner, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

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

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.

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

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Refer to CCDC 2 GC 3.11.

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

.3 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

.4 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.5 Allow 5 days for Consultant's review of each submission.

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

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

.8 Accompany submissions with transmittal letter, in [duplicate], containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification and quantity of each shop drawing, product data and sample.

.5 Other pertinent data.

.9 Submissions include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.10 After Consultant's review, distribute copies.

.11 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.

.12 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.

.13 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Consultant.

.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.

.14 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Consultant.

.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.

.15 Submit electronic copies of manufacturer’s instructions for requirements requested in specification Sections and as requested by Consultant.

.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.

.16 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Consultant

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

.18 Submit Operation and Maintenance Data for requirements requested in specification Sections and as requested by Consultant. Also submit this document in electronic format.

.19 Delete information not applicable to project.

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

.21 If upon review by Consultant, 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.

.22 The review of shop drawings by the Consultant is for sole purpose of ascertaining conformance with general concept.

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

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

1.3 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic and hard copy of colour digital photography in jpg format, standard resolution monthly with progress statement.

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

.3 Frequency of photographic documentation: weekly or as directed by Consultant and/or Owner, and upon completion of: excavation, foundation, framing and services before concealment, as directed by Owner and/or Consultant.

1.4 CERTIFICATES AND TRANSCRIPTS

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

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

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.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 the Ontario Building Code 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

.3 Meet: or exceed requirements of Contract documents and specified standards, codes and referenced documents.

1.3 BUILDING SMOKING ENVIRONMENT

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

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

2.1 PERMITS

.1 Building Permit:

.1 Owner has applied for and will be paying for building permit. Constructor is responsible for obtaining or coordinating other permits required for Work and its various parts.

.2 Constructor will display building permit and other permits in a conspicuous location at Place of Work.

.2 Occupancy Permits:

.1 Constructor will apply for, obtain, and pay for occupancy permits, including partial occupancy permits where required by authority having jurisdiction.

.2 Consultant will issue appropriate instructions to Constructor for correction to Work where Contract Document deficiencies are required to be corrected in order to obtain occupancy permits, including partial occupancy permits.

.3 Constructor will correct deficiencies in accordance with Consultant's instructions. Where deficiency is not corrected, Owner reserves the right to make correction and charge Constructor for costs incurred.

.4 Constructor will turn occupancy permits over to Owner.

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC), CCDC 2, Stipulated Price Contract.

1.2 INSPECTION

.1 Refer to CCDC 2, GC 2.3.

.2 Allow Consultant and Owner 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.

.3 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Owner or Consultant instructions, or law of Place of Work.

.4 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.

.5 Owner or Consultant 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, Owner shall pay cost of examination and replacement.

1.3 INDEPENDENT INSPECTION AGENCIES

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

.2 Allocated costs: to Section 01 21 00 - Allowances.

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

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

.5 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 Consultant at no cost to Owner. Pay costs for retesting and reinspection.

1.4 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.

1.5 PROCEDURES

.1 Notify appropriate agency, Owner and Consultant 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.

1.6 REJECTED WORK

.1 Refer to CCDC, GC 2.4.

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

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

.4 If in opinion of Owner or Consultant 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 Owner and Consultant.

1.7 REPORTS

.1 Submit inspection and test reports to Owner and Consultant.

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

1.8 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 Consultant and may be authorized as recoverable.

1.9 EQUIPMENT AND SYSTEMS

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

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA International): CSA-O121, Douglas Fir Plywood.

1.2 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.3 DUST TIGHT SCREENS

.1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work.

.2 Maintain and relocate protection until such work is complete.

1.4 PROTECTION OF BUILDING FINISHES

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

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Consultant and Owner locations and installation schedule 3 days prior to installation.

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

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC), CCDC 2, Stipulated Price Contract.

.2 Within text of each specifications section, reference may be made to reference standards.

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

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

.5 Cost for such testing will be borne by Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY

.1 Refer to CCDC 2.

.2 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.

.3 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.

.4 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.

.5 Should disputes arise as to quality or fitness of products, decision rests strictly with Owner and/or Consultant based upon requirements of Contract Documents.

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

.7 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 Owner and Consultant 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 Owner or Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Owner or Consultant 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 sheet materials on flat, solid supports and keep clear of ground. Slope to shed moisture.

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

.5 Remove and replace damaged products at own expense and to satisfaction of Owner and Consultant.

.6 Touch-up damaged factory finished surfaces to Owner and Consultant's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 TRANSPORTATION

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

1.6 MANUFACTURER'S INSTRUCTIONS

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

.2 Notify Consultant and Owner in writing, of conflicts between specifications and manufacturer's instructions, so that Owner or Consultant will establish course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Woner and/or Consultant 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 Owner and Consultant if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Consultant and Owner reserve 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 Consultant, 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 Consultant if there is interference. Install as directed by Consultant.

1.10 REMEDIAL WORK

.1 Refer to CCDC 2 Section 01 73 00 - Execution Requirements.

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

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

1.11 LOCATION OF FIXTURES

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

.2 Inform Owner or Consultant 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 exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.13 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.14 PROTECTION OF WORK IN PROGRESS

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

1.15 EXISTING UTILITIES

.1 When tying into or connecting to existing services, execute Work at times directed by Owner, with minimum of disturbance to Work and facility operation.

.2 Protect, relocate or maintain existing active services.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC): CCDC 2, Stipulated Price Contract.

1.2 EXISTING SERVICES

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

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

1.3 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures, and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access, and maintenance.

.3 Submit field drawings to indicate relative position of various services and equipment when required by Owner and Consultant.

1.4 RECORDS

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 Record locations of maintained, re-routed, and abandoned service lines.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 ACTION AND INFORMATIONAL 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.

.3 Include in request:

.1 Identification of project.

.2 Location and description of affected Work.

.3 Statement on necessity for cutting or alteration.

.4 Description of proposed Work, and products to be used.

.5 Alternatives to cutting and patching.

.6 Effect on Work of Owner or separate contractor.

.7 Written permission of affected separate contractor.

.8 Date and time work will be executed.

1.2 MATERIALS

.1 Required for original installation.

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

1.3 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

.5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.4 EXECUTION

.1 Execute cutting, fitting, and patching 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 qualified installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

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

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

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

.11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00 - Firestopping, full thickness of the construction element.

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

1.5 WASTE MANAGEMENT AND DISPOSAL

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

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC): CCDC 2, Stipulated Price Contract.

1.2 PROJECT CLEANLINESS

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

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

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

.4 Provide and use marked separate bins for recycling. Refer to Section 01 74 19- Waste Management and Disposal.

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

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

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

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

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

1.3 FINAL CLEANING

.1 Refer to CCDC 2, GC 3.14.

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

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

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

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

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

.7 Clean and polish glass, hardware, stainless steel, chrome, and mechanical and electrical fixtures. Replace broken, scratched, or disfigured glass.

.8 Remove stains, spots, marks and dirt from electrical and mechanical fixtures, 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 Clean roofs, downspouts, and drainage systems.

.19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.20 Remove snow and ice from access to building.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 19- Waste Management and Disposal

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 WASTE MANAGEMENT GOALS

.1 Prior to start of Work conduct meeting with Owner and Consultant to review and discuss Contractor's proposed Waste Reduction Workplan for Construction waste to be project generated.

.2 Waste management goal: to divert a minimum 75 percent of total Project Waste from landfill sites. Prior to project completion provide Consultant and Owner documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.

.3 Specific material target percentages for reuse and/or recycling:

.1 Electrical - wiring: 75 %.

.2 Packaging: 100%.

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

1.2 REFERENCE STANDARDS

.1 Ontario Ministry of Environment

.1 Ontario Environmental Protection Act (EPA)

.1 Regulation 102/94, Waste Audits and Waste Reduction Workplans.

.2 Regulation 103/94, Source Separation Programs.

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

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 Owner and Consultant

.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 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.

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

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

.7 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

.8 Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prepare and submit following prior to project start-up one (1) copy and one (1) electronic copy of Waste Source Separation Program (WSSP).

.3 Prepare and submit on monthly basis, throughout project or at intervals agreed to by Owner and Consultant the following:

.1 Receipts, scale tickets, waybills, and/or waste disposal receipts that show quantities and types of materials recycled or disposed of.

.2 Written 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.

.2 Provide receipts, scale tickets, waybills, waste disposal receipts that confirm quantities and types of materials reused, recycled or disposed of and destination.

1.5 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 workers in handling and separation of materials for reuse and/or recycling.

.7 Locate separated materials in area which minimizes material damage.

.8 Clearly and securely label containers to identify types/conditions of materials accepted and assist sub-contractors 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.

1.6 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 Owner.

1.7 STORAGE, HANDLING AND PROTECTION

.1 Store, materials to be recycled in locations as directed by Owner or Consultant.

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

.3 Transport and deliver non-salvageable items to licensed disposal facility.

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

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

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

.7 Prevent contamination of materials to be 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.

1.8 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 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.

1.9 SCHEDULING

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

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 APPLICATION

.1 Do Work in compliance with WSSP.

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

3.2 CLEANING

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

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

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

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

.2 Source separate materials to be reused/recycled into specified sort areas.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC) CCDC 2, Stipulated Price Contract.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:

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

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

.2 Request Consultant's and Owner’s inspection.

.2 Owner’s and Consultant's Inspection:

.1 Consultant and Owner to inspect Work and identify defects and deficiencies.

.2 Contractor to correct Work as directed.

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

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

.2 Defects: corrected and deficiencies completed.

.3 Equipment and systems: tested, adjusted and fully operational.

.4 Certificates required by regulatory agencies: submitted.

.5 Operation of systems: demonstrated to Owner's personnel.

.6 Commissioning of mechanical and electrical systems: completed in accordance with 01 91 13 - General Commissioning (Cx) Requirements and two (2) copies of final Commissioning Report submitted to Consultant and Owner.

.7 Work: complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by Consultant and Owner.

.2 When Work is incomplete according to Owner or Consultant, complete outstanding items and request re-inspection.

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

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

.7 Final Payment:

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

.2 When Work deemed incomplete by Owner or Consultant, complete outstanding items and request re-inspection.

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

1.3 FINAL CLEANING

.1 Clean in accordance with Section 01 74 11 – Cleaning: Remove surplus materials, excess materials, rubbish, tools and equipment.

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

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Pre-warranty Meeting:

.1 Convene meeting prior to contract completion with Consultant and Owner Section 01 31 19 - Project Meetings] to:

.1 Verify Project requirements.

.2 Review warranty requirements.

.2 Owner and Consultant to establish communication procedures for:

.1 Notifying construction warranty defects.

.2 Determine priorities for type of defects.

.3 Determine reasonable response time.

.3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.

.4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Two weeks prior to Substantial Performance of the Work, submit to the Owner and Consultant 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. Identify contents of each binder on spine.

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

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

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

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

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

.9 Provide 1:1 scaled CAD files in dxf and dwg format on CD.

1.4 CONTENTS - PROJECT RECORD DOCUMENTS

.1 Table of Contents for Each Volume: provide title of project;

.1 Date of submission; names.

.2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system: 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. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

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

1.5 AS -BUILT DOCUMENTS AND SAMPLES

.1 Maintain, in addition to requirements in General Conditions, 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. 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. Label each document "PROJECT RECORD" in neat, large, printed letters.

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

.5 Keep record documents and samples available for inspection by Consultant and Owner.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

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

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

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

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

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 Referenced Standards to related shop drawings and modifications.

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

.1 Manufacturer, trade name, and catalogue number of each product actually installed particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

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

.7 Provide digital photos, if requested, for site 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 colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.

.1 Include regulation, control, stopping, shut-down, and emergency instructions.

.2 Include summer, winter, and any special operating instructions.

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

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

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

.8 Include sequence of operation by controls manufacturer.

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

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.14 Include test and balancing reports as specified in Section 01 91 13 - General Commissioning (Cx) Requirements and 01 45 00 - Quality Control.

.15 Aboveground storage tank inspection documentation, registration, forms, decommissioning and removal in accordance with CEPA SOR/2008-197.

.16 Additional requirements: as specified in individual specification sections.

1.8 MATERIALS AND FINISHES

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

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

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

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

1.9 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] [site] ; place and store.

.4 Receive and catalogue items. Submit inventory listing to Owner and Consultant. Include approved listings in Maintenance Manual.

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

.2 Extra Stock Materials:

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

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

.3 Deliver to site; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Consultant and Owner

.2 Include approved listings in Maintenance Manual.

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

.3 Special Tools:

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

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

.3 Deliver to site; place and store.

.4 Receive and catalogue items.

1.10 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 Consultant.

1.11 WARRANTIES AND BONDS

.1 Develop warranty management plan to contain information relevant to Warranties.

.2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Consultant and Owner, for approval.

.3 Warranty management plan to include required actions and documents to assure that Owner 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 Consultant and Owner for approval prior to each monthly pay estimate.

.6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:

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

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within [ten] days after completion of applicable item of work.

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

.5 Co-execute submittals when required.

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

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

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

.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 roof, generators, switchgear, commissioned systems, alarm systems, lightning protection system.

.3 Provide list for each warranted equipment, item, feature of construction or system indicating:

.1 Name of item

.2 Model and serial numbers

.3 Location where installed

.4 Name and phone numbers of manufacturers or suppliers

.5 Names, addresses and telephone numbers of sources of spare parts

.6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates

.7 Cross-reference to warranty certificates as applicable

.8 Starting point and duration of warranty period

.9 Summary of maintenance procedures required to continue warranty in force

.10 Cross-Reference to specific pertinent Operation and Maintenance manuals

.11 Organization, names and phone numbers of persons to call for warranty service

.12 Typical response time and repair time expected for various warranted equipment

.4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.

.5 Procedure and status of tagging of equipment covered by extended warranties.

.6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

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

1.12 WARRANTY TAGS

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

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

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

.4 Indicate following information on tag:

.1 Type of product/material.

.2 Model number.

.3 Serial number.

.4 Contract number.

.5 Warranty period.

.6 Inspector's signature.

.7 Construction Contractor.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

.1 Demonstrate operation and scheduled maintenance of equipment and systems to Owner's personnel prior to date of substantial performance.

.2 Owner: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.

.3 Preparation:

.1 Verify conditions for demonstration and instructions comply with requirements.

.2 Verify designated personnel are present.

.3 Ensure equipment has been inspected and put into operation in accordance with the manufacturers' recommendations.

.4 Ensure testing, adjusting, and balancing has been performed and equipment and systems are fully operational.

.4 Demonstration and Instructions:

.1 Demonstrate start-up, operation (in Automatic and Manual modes), control, adjustment, troubleshooting, servicing, and maintenance of each item of equipment at agreed upon times, at the equipment location.

.2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.

.3 Review contents of manual in detail to explain aspects of operation and maintenance.

.4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

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 Owner and Consultant'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 Owner's personnel.

.2 Provide written report that demonstration and instructions have been completed.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.

.2 Acronyms:

.1 Cx - Commissioning

.2 O&M - Operation and Maintenance

.3 PI - Product Information

.4 PV - Performance Verification

.5 TAB - Testing, Adjusting and Balancing

1.2 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with Contract Documents and design criteria and intent.

.2 Ensure appropriate documentation is compiled into the BMM.

.3 Effectively train O&M staff.

.2 Contractor assists in Cx process, operating equipment, and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.

.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.3 Design Criteria: as per client's requirements or determined by designer, to meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

.1 Cx to be a line item of Contractor's cost breakdown.

.2 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.3 Cx is conducted in concert with activities performed during each stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational

requirements. Cx activities include transfer of critical knowledge to facility operational personnel.

.4 Consultant will issue Interim Acceptance Certificate when:

.1 Completed Cx documentation has been received, reviewed for suitability and approved by Consultant and.

.2 Equipment, components, and systems have been commissioned.

.3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Consultant and Owner, to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

.1 Before Construction:

.1 Review Contract Documents and confirm by writing to Owner and Consultant:

.1 Adequacy of provisions for Cx.

.2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction: Co-ordinate provision, location and installation of provisions for Cx.

.3 Before start of Cx:

.1 Have completed Cx Plan up-to-date.

.2 Ensure installation of related components, equipment, sub-systems, systems is complete.

.3 Fully understand Cx requirements and procedures.

.4 Have Cx documentation shelf-ready.

.5 Understand completely design criteria and intent and special features.

.6 Submit complete start-up documentation to Owner and Consultant.

.7 Have Cx schedules up-to-date.

.8 Ensure systems have been cleaned thoroughly.

.9 Complete TAB procedures on systems, submit TAB reports to Consultant and Owner for review and approval.

.10 Ensure "As-Built" system schematics are available.

.4 Inform Consultant and Owner in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Consultant before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

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

.1 Submit no later than 4 weeks after award of Contract:

.1 Name of Contractor's Cx agent.

.2 Draft Cx documentation.

.3 Preliminary Cx schedule.

.2 Request in writing Consultant and Owner for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.

.3 Submit proposed Cx procedures to Consultant and Owner where not specified and obtain written approval at least 8 weeks prior to start of Cx.

.4 Provide additional documentation relating to Cx process required by Consultant and Owner.

1.8 COMMISSIONING DOCUMENTATION

.1 Prepare Commissioning (Cx) Forms including Installation Check Lists and Product Information (PI), Performance Verification (PV) Forms for requirements and instructions for use.

.2 Owner and Consultant to review and approve Cx documentation.

.3 Provide completed and approved Cx documentation to Owner and Consultant.

1.9 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule.

.2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

.1 Approval of Cx reports.

.2 Verification of reported results.

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

.4 Training.

1.10 COMMISSIONING MEETINGS

.1 Convene Cx meetings following project meetings as specified herein.

.2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.

.3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.

.4 At 60% construction completion stage. Owner and Consultant to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:

.1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.

.2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.

.5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.

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

.7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

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

1.12 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days' notice prior to commencement.

.2 Consultant and Owner to witness of start-up and testing.

.3 Contractor's Cx Agent (if any) to be present at tests performed and documented by sub-trades, suppliers, and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

.1 Factory testing - Manufacturer to:

.1 Coordinate time and location of testing.

.2 Provide testing documentation for approval by Owner and Consultant

.3 Arrange for Owner and Consultant to witness tests.

.4 Obtain written approval of test results and documentation from Owner and Consultant before delivery to site.

.2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Owner and Consultant

.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

.3 Integrity of warranties:

.1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.

.2 Verify with manufacturer that testing as specified will not void warranties.

.4 Qualifications of manufacturer's personnel:

.1 Experienced in design, installation and operation of equipment and systems.

.2 Ability to interpret test results accurately.

.3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and testing in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.

.2 Visual inspection of quality of installation.

.2 Start-up: follow accepted start-up procedures.

.3 Operational testing: document equipment performance.

.4 System PV: include repetition of tests after correcting deficiencies.

.5 Post-substantial performance verification: to include fine-tuning.

.3 Correct deficiencies and obtain approval from Consultant and Owner after distinct phases have been completed and before commencing next phase.

.4 Document require tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Owner or Consultant. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:

.1 Minor equipment/systems: implement corrective measures approved by Consultant.

.2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Consultant.

.3 If evaluation report concludes that major damage has occurred, Owner and/or Consultant shall reject equipment.

.1 Rejected equipment to be remove from site and replace with new.

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

1.15 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to Consultant and Owner for approval before commencement of commissioning.

.2 Start-up documentation to include:

.1 Factory and on-site test certificates for specified equipment.

.2 Pre-start-up inspection reports.

.3 Signed installation/start-up check lists.

.4 Start-up reports,

.5 Step-by-step description of complete start-up procedures, to permit Consultant and Owner to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer develop written maintenance program and submit to Consultant for approval before implementation.

.3 Operate and maintain systems for length of time required for commissioning to be completed.

.4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

.1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF COMMISSIONING

.1 Notify Owner and Consultant at least 21days prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under accepted simulated operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

1.20 WITNESSING COMMISSIONING

.1 Consultant to witness activities and verify results.

1.21 EXTENT OF VERIFICATION

.1 Provide manpower and instrumentation to verify up to 30% of reported results, unless specified otherwise in other sections.

.2 Number and location to be at discretion of Owner and Consultant.

.3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.

.4 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.

.5 Perform additional commissioning until results are acceptable to Owner and Consultant.

1.22 REPEAT VERIFICATIONS

.1 Assume costs incurred by Consultant and/or Owner for third and subsequent verifications where:

.1 Verification of reported results fail to receive Owner and Consultant's approval.

.2 Repetition of second verification again fails to receive approval.

.3 Consultant or Owner deems Contractor's request for second verification was premature.

1.23 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to satisfaction of Consultant and Owner.

.2 Report problems, faults or defects affecting Cx to Consultant and Owner in writing. Stop Cx until problems are rectified. Proceed with written approval from Owner or Consultant.

1.24 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Owner and Consultant.

1.25 ACTIVITIES UPON COMPLETION OF COMMISSIONING

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

1.26 TRAINING

.1 In accordance with Section 01 79 00 – Demonstration and Training.

1.27 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

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

1.28 OCCUPANCY

.1 Cooperate fully with Owner and Consultant during all stages of acceptance and occupancy of facility.

1.29 OWNER'S PERFORMANCE TESTING

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

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION

ARCHITECTURAL SPECIFICATIONS

PART 1- GENERAL

1.1 SUMMARY

.1 This Section includes:

.1 Demolition and removal of selected portions of interior building components and finishes.

.2 Repair procedures for selective demolition operations.

.2 This section does not include:

.1 Removal of hazardous materials or asbestos abatement.

.2 Demolition of exterior building components or structural elements.

.3 Mechanical or electrical equipment, except as required to make minor modifications to allow the work to be completed.

1.2 RELATED SECTIONS

.1 Section 01 11 00 – Summary of Work

.2 Section 01 35 29.06 - Health and Safety Requirements

.3 Section 01 35 43 - Environmental Procedures

.4 Section 01 35 99 – Dust Control Procedures

.5 Section 01 52 00 – Construction Facilities

.6 Section 01 56 00 - Temporary Barriers and Enclosures

.7 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

1.3 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI A10.8, Safety Requirements for Scaffolding.

.2 CSA Group (CSA)

.1 CSA S350, Code of Practice for Safety in Demolition of Structures.

.3 National Fire Protection Association (NFPA)

.1 NFPA 241 13, Standard for Safeguarding Construction, Alteration, and Demolition Operations

1.4 DEFINATIONS

.1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstalled.

.2 Remove and Salvage: Detach items from existing construction and deliver them to Owner.

.3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

.4 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed, and salvaged, or removed and reinstalled.

.5 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities, and hazardous products may include asbestos, mercury and lead, PCBs, 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 the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property demolished materials shall become Contractor's property and shall be removed from Project site.

.2 Coordinate selective demolition work so that work of this Section adheres to aesthetic criteria established by the Drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.

.3 Pre-Demolition Meeting: Convene pre-installation meeting one (1) week prior to beginning work of this Section, with Owner to:

.1 Confirm extent of salvaged and demolished materials.

.2 Review Contractor's demolition plan:

.1 Verify existing site conditions adjacent to demolition work.

.2 Coordination with other construction sub trades.

1.6 ACTION AND INFORMATION SUBMITTALS

.1 Provide the following submittals before starting any work of this Section:

.1 Schedule of Selective Demolition Activities:

.1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.

.2 Coordinate with Owner ongoing site operations and limit the number of interruptions during regular business hours.

.3 Interruption of utility services.

.4 Coordination for shutoff, capping, and continuation of utility services.

.5 Use of elevator and stairs.

.6 Locations of temporary partitions and means of egress, including for others affected by selective demolition operations.

.7 Coordination with Owner continuing occupancy of portions of existing building and of partial occupancy of completed Work.

.2 Demolition Plan: Submit a plan of demolition area indicating extent of temporary facilities and supports, methods of removal and demolition prepared by a professional engineer in accordance with requirements of Authority Having Jurisdiction, and as follows:

.1 Proposed Noise Control and Dust Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Owner reserves the right to make modifications where proposed methods interfere with the Owner's ongoing operation.

.2 Inventory: Submit a list of items that have been removed and salvaged after selective demolition is complete.

1.7 SITE CONDITIONS

.1 Owner will occupy portions of building immediately adjacent to selective demolition area:

.1 Conduct selective demolition so that Owner's operations will not be disrupted.

.2 Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

.2 Maintain access to existing means of egress, walkways, corridors, exits, and other adjacent occupied or used facilities:

.1 Do not close or obstruct means of egress, walkways, corridors, exits, or other occupied or used facilities without written acceptance from authorities having jurisdiction.

.3 Discovery of Hazardous Substances:

.1 It is not expected that Hazardous Substances will be encountered in the Work. Immediately notify Owner if materials suspected of containing hazardous substances are encountered.

PART 2- PRODUCTS

2.1 DESCRIPTION

.1 This section of the Work includes, but is not necessarily limited to, the following:

.1 Demolition, removal completely from site, and disposal of all identified components, materials, equipment, and debris.

.2 Selective demolition to allow new walls, bulkheads, ceilings, and other materials to meet existing construction as indicated.

.3 All material from demolition shall be removed from site immediately with no salvage, selling, sorting, or burning permitted on site.

.4 Retain items indicated on drawings for re use in new construction.

2.2 DEBRIS

.1 Make all arrangements for transport and disposal of all demolished materials from the site.

2.3 EQUIPMENT

.1 Provide all equipment required for safe and proper demolition of the building interiors indicated.

2.4 REPAIR MATERIALS

.1 Use repair materials identical to existing materials:

.1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

.2 Use a material whose installed performance equals or surpasses that of existing material.

.3 Comply with material and installation requirements specified in individual Specification Sections.

.2 Floor Patching and Levelling Compounds: Cement-based, trowel-able, self levelling compounds compatible with specified floor finishes. Gypsum-based products are not acceptable for work of this Section.

.3 Concrete Unit Masonry: Lightweight concrete masonry units, and mortar, cut and trimmed to fit existing opening to be filled. Provide standard hollow core units, square end units and bond beam units as indicated on drawings.

.4 Gypsum Board Patching Compounds: Joint compound to ASTM C475/C475M, bedding and finishing types thinned to provide skim coat consistency to patch and prepare existing gypsum board walls ready for new finishes in accordance with Section 09 21 16 – Gypsum Board Assemblies.

.5 Hoarding and Dust Screens: Refer to Sections 01 35 99 – Dust Control Procedures and 01 56 00 - Temporary Barriers and Enclosures for stud framing and gypsum board sheathing materials.

2.5 EXISTING MATERIALS

.1 Items to be retained for re use in new construction include, but are not limited to the following:

.1 Security glass panel as indicated on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify that utilities have been disconnected and capped.

.2 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

.3 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

.4 Notify the Owner where existing mechanical, electrical, or structural elements conflict with intended function or design:

.1 Investigate and measure the nature and extent of conflict and submit a written report to Consultant.

.2 Consultant will issue additional instructions or revise drawings as required to correct conflict.

.5 Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

.1 Coordinate existing services indicated to remain and protect them against damage during selective demolition operations.

.2 Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

.1 Arrange to shut off affected utilities with utility companies.

.2 If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.

.3 Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

.4 Cut off pipe or conduit to a minimum of 25 mm below slab and remove concrete mound. Patch concrete using cementitious grout.

.3 Coordinate with Mechanical and Electrical Divisions for shutting off, disconnecting, removing, and sealing or capping utilities.

.4 Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

.1 Identify and mark all equipment and materials identified to be retained by Owner or to be reused in subsequent construction. Separate and store items to be retained in an area away from area of demolition and protect from accidental disposal.

.2 Post warning signs on electrical lines and equipment that must remain energized to serve other areas during period of demolition.

.3 Confirm that all electrical and telephone service lines entering buildings are not disconnected.

.4 Do not disrupt active or energized utilities crossing the demolition site.

.5 Provide and maintain barricades, warning signs, protection for workmen and the public during the full extent of the Work. Read drawings carefully to ascertain extent of protection required.

.6 Mark all materials required to be re used, store in a safe place until ready for re installation.

.7 Adjust all junction boxes, receptacles, and switch boxes flush with new wall construction where additional layers to existing construction are indicated.

.8 Remove permanent marker lines used or found on exposed surfaces and at surfaces indicated for subsequent finish materials. Mechanically remove permanent marker lines and associated substrates where permanent marker lines occur and patch surface. Sealing or priming over permanent marker lines is not acceptable.

3.4 SELECTIVE DEMOLITION

.1 Demolish and dismantle work in a neat and orderly manner and in strict accordance with all regulations.

.2 At end of each day's work, leave Work in safe condition so that no part is in danger of toppling or falling.

.3 Demolish in a manner to minimize dusting and to prevent migration of dust.

.4 Selling or burning of materials on the site is not permitted.

.5 Fill all openings in concrete block walls with concrete masonry units, coursing to match existing, prepare ready to receive new finishes to match existing.

.1 Provide bond beams in new openings cut into existing concrete masonry unit walls.

.2 Provide finished end masonry units to patch and repair for new jamb sections in existing concrete masonry unit walls.

.6 Fill all openings in gypsum board walls with gypsum board and steel framing to match existing, skim coat to make wall smooth and even.

.7 Demolish existing carpet, resilient flooring and adhesive remnants as follows:

.1 Vacuum existing carpet thoroughly, prior to removal, using vacuum equipped with power head/sweeper.

.2 Apply fine mist water spray to carpet as required to minimize dust generation during removal. Avoid spraying near electrical outlets.

.3 Demolish existing carpet and resilient floor finishes, remove and dispose of offsite.

.4 Remove adhesive to the greatest extent possible using scrapping tools and as follows:

.1 Do not use solvent based cleaners to remove adhesive remnants.

.2 Vacuum floor ready for application of skim coating.

.3 Repair all slab depressions and damage with cementitious patching compound.

.4 Skim coat floor with minimum 1 mm thick cementitious floor underlayment compatible with new flooring materials.

.5 Floor substrate shall be smooth, free from ridges and depressions, and adhesive remnants that could telegraph through resilient flooring materials and carpets.

.8 Demolish completely all ceiling panels and grid as indicated.

.9 Remove all wall coverings scheduled for demolition. Patch and repair wall surfaces with skim coat of gypsum board joint compound leaving wall surfaces smooth and even ready for new wall finishes.

.10 Patch and repair all walls, floor and ceilings damaged during demolition with material matching adjacent walls, prepare ready for new finishes.

.11 Patch and repair all mechanical and electrical equipment and fixtures damaged or exposed during demolition to match adjacent finished surfaces.

3.5 PATCHING AND REPAIRING

.1 Floors and Walls:

.1 Where walls or partitions that are demolished extend from one finished area into another, patch and repair floor and wall surfaces in the new space.

.2 Provide a level and smooth surface having uniform finish colour, texture, and appearance.

.3 Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform colour and appearance.

.4 Patch with durable seams that are as invisible as possible.

.5 Provide materials and comply with installation requirements specified in other Sections of these Specifications.

.6 Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.

.7 Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

.2 Ceilings: patch, repair, or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

3.6 PROTECTION

.1 Protect mechanical and electrical systems and services that must remain in operation from debris.

.2 Arrange demolition and shoring work so that interference with the use of adjoining areas by the Owner and users is minimized.

.3 Maintain safe access to and egress from occupied areas adjoining.

.4 Provide and maintain fire prevention equipment and alarms accessible during demolition.

3.7 CLEANING

.1 Promptly as the Work progresses, and on completion, clean up and remove from the site all rubbish and surplus material. Remove rubbish resulting from demolition work daily.

.2 Maintain access to exits clean and free of obstruction during removal of debris.

.3 Keep surrounding and adjoining roads, lanes, sidewalks, municipal rights of way clean and free of dirt, soil or debris that may be a hazard to vehicles or persons.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

.1 This section includes design, labour, products, and services necessary for caulking and sealant work, in accordance with the Contract Documents.

.2 All requirements of Division 01 apply to this section and are to be read in conjunction.

1.2 RELATED SECTIONS

.1 Metal Doors and Frames ..... Section 08 11 00.

.2 Gypsum Board Assemblies..... Section 09 21 16.

.3 Conductive Elastomeric Liquid Flooring..... Section 09 67 13.

1.3 REFERENCES

.1 ASTM International

.1 ASTM C919-08, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).

.2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).

.4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

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

.1 Material Safety Data Sheets (MSDS).

1.4 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Manufacturer's product to describe:

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.

.3 Samples:

.1 Submit 2 samples of each type of material and colour.

.2 Cured samples of exposed sealants for each colour where required to match adjacent material.

.4 Manufacturer's Instructions:

.1 Submit instructions to include installation instructions for each product used.

1.5 CLOSEOUT SUBMITTALS

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

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

1.7 SITE CONDITIONS

.1 Ambient Conditions:

.1 Proceed with installation of joint sealants only when:

.1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.

.2 Joint substrates are dry.

.3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Joint-Width Conditions:

.1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Health Canada.

1.9 EXTENDED WARRANTY

.1 Warrant sealant Work in accordance with General Conditions, except that warranty period is extended for a period of 10 years against defects and deficiencies. Promptly correct to satisfaction of Owner and at no expense to the Owner, any defects or deficiencies which become apparent within warranty period. Defects include, but are not limited to cracking, crumbling, melting, shrinkage, sag, failure in adhesion, cohesion or reversion, air and moisture leakage, marbling or streaking due to improper mixing, discolouration due to dirt pick-up during curing and staining of adjacent materials spalling or visible evidence of cracking, except for hairline shrinkage cracks. Warranty shall cover complete replacement.

1.10 QUALITY ASSURANCE

.1 Qualifications: Execute Work by applicators trained and approved by manufacturer having five (5) years proven experience.

1.11 MOCK-UP

.1 Construct mock-up to show location, size, shape, and depth of joints complete with bond breaker, joint backing, primer and sealant. Accepted mock-up may become part of finished Work.

.2 Allow 48 hours for review of mock-up by Consultant before proceeding with sealant Work.

1.12 PRE-INSTALLATION MEETINGS

.1 Arrange with manufacturer's representative to inspect substrates, and to review installation procedures 48 hours in advance of installation.

.2 Review conditions under which Work will be done.

.3 Joint condition and profile.

.4 Weather conditions.

PART 2 - PRODUCTS

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals, or is not certified as mold resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.3 Where sealants are qualified with primers use only these primers.

.4 Sealants used on fire rated assemblies must conform to UL/ULC requirements.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 ASTM C920 Designation:

.1 Type S – Single Component Sealant.

.2 Type M – Multicomponent Sealant.

.3 Grade NS – Non-sag, gunable for vertical joints.

.4 Class 25 – Adhesion / Cohesion withstands min 25% increase / decrease of joint width.

.5 Class 12.5 - Adhesion / Cohesion withstands min 12 ½ % increase / decrease of joint width.

.6 NT – Non traffic areas.

.7 M – Mortar.

.2 CAN/CGSB-19.13 M Sealant Classification

.1 Substrate of major use:

.1 Class M - Metal

.2 Class C - Concrete or masonry

.2 Rheological properties:

.1 Class 1 - Self-levelling

.2 Class 2 - Non-sag

.3 Movement:

.1 Class 25 - ±25%

.2 Class 40 - ±40%

.4 Temperature:

.1 Class N - Min application temp. 5 deg.

.3 CAN/CGSB 19.24 M Sealant Classification:

.1 Type 2 - Non-sag

.2 Class B - Non-glazing application

2.3 SEALANT SELECTION

.1 Silicone Sealant Type E:

.1 CAN/CGSB 19.13-M, MCG-2-40-B-N, ASTM C920: Type S, Grade N S, Class 25, use NT, M, G, A; one component, structural glazing, glazing, weatherproofing, 100% silicone base chemical curing, in standard colours selected.

.2 Silicone Sealant Type F:

.1 CAN/CGSB 19.13-M, MCG-2-40-B-N, ASTM C920: Type S, Grade NS, use T, NT, M, Class 25; one component, weatherproofing, 100% silicone base chemical curing, in standard colours selected.

2.4 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.

.2 Primer: in accordance with sealant manufacturer's written recommendations.

2.5 PRIMERS:

.1 Type recommended by material manufacturers for various substrates, to promote adhesion and to prevent staining of adjacent surfaces for conditions encountered on project.

2.6 JOINT BACKING:

.1 Round, solid section, skinned surface, soft polyethylene foam gasket stock, compatible with primer and sealant materials, 30 to 50% oversized, Shore A hardness of 20, tensile strength 140 to 200 kPa. Bond breaker type surface.

2.7 BOND BREAKER:

.1 Type recommended by material manufacturers to prevent bonding of sealant to back of recess.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for joint sealants installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Owner and Consultant.

.2 Inform Owner and Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Owner and Consultant.

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

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

3.6 APPLICATION

.1 Sealant:

.1 Apply sealant in accordance with manufacturer's written instructions.

.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

.3 Apply sealant in continuous beads.

.4 Apply sealant using gun with proper size nozzle.

.5 Use sufficient pressure to fill voids and joints solid.

.6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.7 Tool exposed surfaces before skinning begins to give slightly concave shape.

.8 Remove excess compound promptly as work progresses and upon completion.

.2 Curing:

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

3.7 SCHEDULE OF LOCATIONS

.1 Following sealant location schedule is included for convenience and may not be complete. Examine Contract documents and determine entire extent of Work of this Section. Generally seal following locations:

.2 Sealant Type E:

.1 Expansion joints for new and remedial applications.

.2 Primarily glazing sealant, structural glazing and perimeter sealing of doors and window frames.

.3 Suitable as well for wood, vinyl, aluminum surfaces.

.4 Not suitable for below grade applications, brass, surfaces continuously immersed in water, interior penetration fire stop, building materials that bleed oils (impregnated wood, oil-based caulks, vulcanized rubber gaskets or tapes or bituminous below grade waterproofing and asphalt-impregnated fibreboard), totally confined spaces, surfaces to be painted, surfaces in direct contact with wood.

.3 Sealant Type F:

.1 Expansion and control joints for new and remedial applications.

.2 Primarily for joints in building materials, and masonry and remedial applications.

.3 Suitable as well for glass, metal and plastics in glazing and curtainwall assemblies.

.4 Not suitable for below grade applications, brass, surfaces continuously immersed in water, interior penetration fire stop, building materials that bleed oils (impregnated wood, oil-based caulks, vulcanized rubber gaskets or tapes or bituminous below grade waterproofing and asphalt-impregnated fibreboard), totally confined spaces, surfaces to be painted, surfaces in direct contact with wood.

3.8 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by joint sealants installation.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Clean adjacent surfaces immediately.

.3 Remove excess and droppings, using recommended cleaners as work progresses.

.4 Remove masking tape after initial set of sealant.

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

3.10 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by joint sealants installation.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

.1 This section includes design, labour, products, and services necessary for interior metal doors and frames in accordance with the Contract Documents.

.2 All requirements of Division 01 apply to this section and are to be read in conjunction.

1.2 RELATED SECTIONS

.1 Joint Sealant ..... Section 07 92 00.

.2 Door Hardware ..... Section 08 71 00.

.3 Gypsum Board Assemblies ..... Section 09 21 16.

.4 Interior Painting ..... Section 09 91 23.

1.3 REFERENCES

.1 Ontario 2012 Building Code.

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

.1 ASTM A653/A653M-06a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM C553-13, Standard Specification for Mineral Fibre Blanket Insulation for Commercial and Industrial Applications.

.3 ASTM C578-14a, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

.4 ASTM C591-13, Specification for Un-Faced Pre-formed Rigid Cellular Polyisocyanurate Thermal Insulation.

.5 ASTM C1289-14a, Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.4 Canadian Standards Association (CSA International)

.1 CSA-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59-03, Welded Steel Construction (Metal Arc Welding).

.5 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2006.

.2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 2009.

.6 National Fire Protection Association (NFPA)

.1 NFPA 80-99, Standard for Fire Doors and Fire Windows.

.2 NFPA 252-03, Standard Methods of Fire Tests of Door Assemblies.

.7 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S702-14, Standard for Thermal Insulation, Mineral Fibre, for Buildings.

.2 CAN/ULC-S704-03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

.3 CAN4-S104-10, Standard Method for Fire Tests of Door Assemblies.

.4 CAN4-S105-09, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.4 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 NFPA 252 for ratings specified or indicated.

.2 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104, ASTM E152 and NFPA 252 and listed by nationally recognized agency having factory inspection services.

1.5 QUALIFICATIONS

.1 Approved Manufacturers:

.1 Fleming Door Products,

.2 Dean Steel,

.3 Daybar Industries Ltd. or,

.4 Approved alternate.

1.6 SUBMITTALS

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

.2 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

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

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, arrangement of hardware fire rating and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, reinforcing and fire rating finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.5 Submit test and engineering data, and installation instructions.

.3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.4 Submit one 12” x 12” (300 x 300 mm) corner sample of each type of frame.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Waste Management and Disposal:

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

1.8 WARRANTY

.1 Minimum ten (10) years warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Reinforcement [channel]: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

.3 Minimum Thicknesses

	Gauge	Equivalent Thickness	
	No	Inches	Millimeters
Frames	16	0.060	1.52
Doors-Hollow steel construction			
Door faces	18	0.048	1.21
Top and bottom end channels	18	0.048	1.21
Vertical stiffeners	20	0.036	0.91
Accessories			
Lock and strike reinforcements	16	0.060	1.52
Hinge reinforcements	10	0.135	3.42
Flush bolt reinforcements	16	0.060	1.52
Reinforcements for surface applied hardware	12	0.105	2.66
Door closer or holder reinforcements	12	0.105	2.66
Wall Anchors			
Steel Stud type	16	0.060	1.52
Jamb floor anchors	16	0.060	1.52
Jamb spreaders	18	0.048	1.21
Mortar guard boxes	22	0.030	0.76

2.2 DOOR CORE MATERIALS

.1 Honeycomb construction: Interior Doors

.1 Structural small cell, 1” (24.5 mm) maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m3 minimum sanded to required thickness.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.1 Adhesive: maximum VOC content 50 g/L.

.2 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMER

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

.1 Maximum VOC limit 50 g/L to GC-03.

2.5 PAINT

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

.1 Maximum VOC emission level 50 g/L to GS-11.

2.6 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior, interior, top and bottom caps: conforming to CGSB 41-GP-19Ma steel.

.3 Door bottom seal: Automatic door bottom.

.4 Metallic paste filler: to manufacturer's standard.

.5 Fire labels: metal riveted.

.6 Sealant: in accordance with Section 07 92 00 – Joint Sealants.

.1 Maximum VOC limit 250 g/L.

2.7 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Interior frames: 1.2 mm welded type construction.

.4 Blank, reinforce, drill and tap frames for mortised, templated hardware, electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.5 Protect mortised cutouts with steel guard boxes.

.6 Prepare frame for door silencers, 3 for single door.

.7 Manufacturer's nameplates on frames and screens are not permitted.

.8 Conceal fastenings except where exposed fastenings are indicated.

.9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.10 Prepare frames to receive electronic monitoring and security devices. Refer to Section 08 71 00 – Door Hardware. Coordinate frame preparation with Electrical Divisions 26.

2.8 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebbet opening heights up to 5’-0” (1520 mm) and 1 additional anchor for each additional 2’-6” (760 mm) of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 6” (150 mm) from top and bottom of each jamb and intermediate at 26” (660 mm) on centre maximum.

2.9 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

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

2.10 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, as indicated.

.2 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.

.3 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware.

.4 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.5 Factory prepare holes 1/2” (12.7 mm) diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.6 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.8 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN4-S104, ASTM E152 and NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

.9 Manufacturer's nameplates on doors are not permitted.

2.11 DOORS: HONEYCOMB CORE CONSTRUCTION

.1 Form face sheets for interior doors from (1.6 mm) sheet steel with honeycomb core laminated under pressure to face sheets.

2.12 HOLLOW STEEL CONSTRUCTION

.1 Form face sheets for exterior doors from (1.6 mm) sheet steel.

.2 Form face sheets for interior doors from (1.6 mm) sheet steel.

.3 Reinforce doors with vertical stiffeners, securely welded to face sheets at 6” (150 mm) on centre maximum.

.4 Fill voids between stiffeners of interior doors with batt insulation core.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 4’-0” (1200 mm) wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Apply sealant at perimeter of frames between frame and adjacent material.

3.4 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.

.1 Hinge side: 1.0 mm.

.2 Latch side and head: 1.5 mm.

.3 Finished floor, top of carpet, noncombustible sill, and thresholds: 3/8” (10 mm).

.3 Adjust operable parts for correct function.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

.1 This section includes design, labour, products, and services necessary for door hardware, in accordance with the Contract Documents.

.2 All requirements of Division 01 apply to this section and are to be read in conjunction.

1.2 RELATED REQUIREMENTS

.1 Metal Doors and Frames ..... Section 08 11 00.

1.3 REFERENCES

.1 Ontario 2012 Building Code.

.2 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)

.1 ANSI/BHMA A156.1-2000, American National Standard for Butts and Hinges.

.2 ANSI/BHMA A156.2-2003, Bored and Preassembled Locks and Latches.

.3 ANSI/BHMA A156.4-2000, Door Controls - Closers.

.4 ANSI/BHMA A156.5-2001, Auxiliary Locks and Associated Products.

.5 ANSI/BHMA A156.6-2005, Architectural Door Trim.

.6 ANSI/BHMA A156.8-2005, Door Controls - Overhead Stops and Holders.

.7 ANSI/BHMA A156.13-2002, Mortise Locks and Latches Series 1000.

.8 ANSI/BHMA A156.16-2002, Auxiliary Hardware.

.9 ANSI/BHMA A156.18-2006, Materials and Finishes.

.3 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)

.1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.4 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish, and hardware package number.

.4 After approval samples will be returned for incorporation in Work.

.4 Hardware List:

.1 Submit contract hardware list.

.2 Indicate specified hardware, including make, model, material, function, size, finish, and other pertinent information.

.5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.5 CLOSEOUT SUBMITTALS

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

.2 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.

1.6 MAINTENANCE MATERIALS SUBMITTALS

.1 Extra Stock Materials:

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

.2 Tools:

.1 Supply 2 sets of wrenches for door closers and locksets.

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.4 Storage and Handling Requirements:

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

.2 Store and protect door hardware from nicks, scratches, and blemishes.

.3 Protect prefinished surfaces with wrapping and strippable coating.

.4 Replace defective or damaged materials with new.

.5 Develop Construction Waste Management Plan related to Work of this Section.

.6 Packaging Waste Management: remove for reuse of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 HARDWARE ITEMS

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

.2 Approved Manufacturers

.1 Butts and Hinges: Hager Hinge or Stanley or McKinney

.2 Locksets, Latchsets: Corbin Russwin, Sargent

.3 Floor/Wall Stops: Glynn-Johnson, Rockwood

.4 Kickplates: K.N. Crowder Mfg. Co., Rockwood

.5 Door Closers: L.C.N. Door Closers, Norton, Sargent

.6 Overhead door stops and Holders Glynn-Johnson Ltd., Rixson

.7 Automatic door bottom: K.N. Crowder Mfg. Co., Pemko

.8 Or Approved alternatives.

2.2 DOOR HARDWARE

.1 Locks and latches:

.1 All mortise sets to come complete with three-point anti-friction latchbolt, thru-bolted trim. Mortise locks and latches: to ANSI/BHMA A156.13, designed for function and keyed as stated in Hardware Schedule.

.2 Lever handles:

.1 Sargent 8200 Series.

.2 Schlage ND Series.

.3 Richelieu FC Series.

.4 Approved alternative to match existing.

.3 Escutcheons: round.

.4 Provide hardware to match existing finish. Acceptable alternative: 626 Satin Chrome finish.

.2 Keying

.1 Provide a quantity of Master Keys/Misc. Keys/Key Blanks, as called for by Owner.

.2 All locking devices, without exception, shall be subject to established Corbin Russwin Grand Master system. Multiplex 6D4.

.3 Keying shall be as follows:

.1 All cylinders subject to line Grand Master Key.

.2 All cylinders subject to Construction Master Key.

.3 Construction cylinders to be supplied by Contractor for use during construction of new facilities.

.4 Keying system shall be based on owner's requirements.

.3 Butts and hinges:

.1 Butts and hinges: to ANSI/BHMA A156.1, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.

.4 Door Closers and Accessories:

.1 Door controls (closers): to ANSI/BHMA A156.4, designated in Door and Hardware Schedule, size in accordance with ANSI/BHMA A156.4, table A1.

.2 All surface mounted door closers to be fastened with through bolts and grommet or hex bolts and machine screws.

.3 Doors and frames must be reinforced as required.

.5 Door Controls

.1 Overhead Stops/Holders - Overhead stops to be Glynn-Johnson or Rixson 1 Series, or approved alternate concealed type, ULC listing where required.

.2 Finish to be 626 Satin Chrome except where fitted to doors which have special finishes or coatings in which case the stop is to be the same finish, ULC listing where required.

.6 Architectural door trim to ANSI/BHMA A156.6, designated by letter J and numeral identifiers listed in Hardware Schedule as listed below:

.1 Door protection plates: kick plate, 1.27 mm thick stainless steel.

.2 Sweep:

.1 Automatic door bottom: Extruded clear anodized Aluminum with Neoprene.

.2 Approved alternative.

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Use fasteners compatible with material through which they pass.

PART 3 - INSTALLATION

3.1 EXAMINATION

.1 Before supplying materials, ensure by a check of drawings, shop drawings and details prepared for the project, that listed hardware is suitable by dimension and function for intended purposes.

3.2 INSTALLATION

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

.2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Supply manufacturers' instructions for proper installation of each hardware component.

.4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).

.5 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.6 Use only manufacturer's supplied fasteners.

.1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.7 Remove construction locks when directed by Owner and Consultant.

.1 Install permanent cores and ensure locks operate correctly.

3.3 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment, and other moving parts.

.3 Adjust door hardware to ensure tight fit at contact points with frames.

.4 Upon occupancy of building arrange an appointment with Owner's designated representative to instruct this person in the proper use, servicing, adjusting and maintenance of hardware.

3.4 MOUNTING HEIGHTS

.1 The following is a schedule based on Ontario 2012 Building Code:

.1 Locks/Latches: not less than 36 inch (900 mm) and not more than 43 inch (1100 mm) from center of strike to finished floor.

.2 The above mounting heights are to be considered a general guide. the Installer must carefully check manufacturer's installation instructions packed with hardware products.

.3 Conform to the requirements of the Ontario Building Code Section 3.8 and C.S.A. Standard CAN/CSA-B651-M90 for mounting hardware for barrier-free access routes and areas.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.

.3 Remove protective material from hardware items where present.

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

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

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 DEMONSTRATION

.1 Keying System Setup:

.1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.

.2 Turn over key to Owner and Consultant.

.2 Maintenance Staff Briefing:

.1 Brief maintenance staff regarding:

.1 Proper care, cleaning, and general maintenance of projects complete hardware.

.2 Description, use, handling, and storage of keys.

.3 Use, application, and storage of wrenches for door closers, and locksets.

.3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.7 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by door hardware installation.

3.8 SCHEDULE

.1 Refer to Door and Hardware Schedule on Architectural drawings.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

.1 The work in this section includes design, labour, products, and services necessary for walls and partitions work in accordance with the Contract Documents.

.2 All requirements of Division 01 apply to this section and are to be read in conjunction.

1.2 RELATED SECTIONS

.1 Joint Sealants ..... Section 07 92 00.

.2 Metal Doors and Frames ..... Section 08 11 00.

.3 Non-Structural Metal Framing ..... Section 09 22 16.

.4 Conductive Elastomeric Liquid Flooring ..... Section 09 67 13.

.5 Interior Painting ..... Section 09 91 23.

1.3 REFERENCES

.1 Ontario 2012 Building Code.

.2 Aluminum Association (AA)

.1 AA DAF 45-03 (R2009), Designation System for Aluminum Finishes.

.3 ASTM International

.1 ASTM C475-02 (2007), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.2 ASTM C514-04(2009e1), Standard Specification for Nails for the Application of Gypsum Board.

.3 ASTM C840-08, Standard Specification for Application and Finishing of Gypsum Board.

.4 ASTM C954-07, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

.5 ASTM C1002-07, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.6 ASTM C1047-09, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.7 ASTM C1280-99, Standard Specification for Application of Gypsum Sheathing.

.8 ASTM C1177/C1177M-08, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

.9 ASTM C1178/C1178M-08, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.

.10 ASTM C1396/C1396M-09a, Standard Specification for Gypsum Wallboard.

.4 Association of the Wall and Ceilings Industries International (AWCI)

.1 AWCI Levels of Gypsum Board Finish-97.

.5 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-71.25-M88, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

.6 Green Seal Environmental Standards (GS)

.1 GS-11-2008, 2nd Edition, Paints and Coatings.

.7 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-07, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.4 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Submit duplicate 12 x 12 inches (300 x 300 mm) size samples of vinyl faced gypsum board and 12 inches (300 mm) long samples of corner and casing beads textured finishes.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store gypsum board assemblies’ materials indoors and in dry location, in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.

.3 Protect from weather, elements, and damage from construction operations.

.4 Handle gypsum boards to prevent damage to edges, ends, or surfaces.

.5 Protect prefinished aluminum surfaces with wrapping strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

.6 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 -Construction/Demolition Waste Management and Disposal.

1.6 AMBIENT CONDITIONS

.1 Maintain temperature 10 degrees C minimum, 21 degrees C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Gypsum Board: to ASTM C1396/C1396M

.1 Regular type: 5/8 inch (15.9 mm) thick, 4 feet (1200 mm) wide x maximum practical length, ends square cut, edges squared.

.1 Acceptable materials: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

.1 CGC Inc., Sheetrock.

.2 Georgia-Pacific Canada, Inc., Toughrock Gypsum Wallboard.

.3 CertainTeed, ProRoc Wallboard.

.2 Metal furring runners, hangers, tie wires, inserts, and anchors.

.3 Nails: to ASTM C514.

.4 Steel drill screws: to ASTM C1002.

.5 Stud adhesive: to CAN/CGSB-71.25 and ASTM C557.

.6 Laminating compound: as recommended by manufacturer, asbestos-free.

.7 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, metal, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one piece length per location.

.8 Section 07 92 00 - Joint Sealants:

.1 VOC limit 250 g/L maximum.

.2 Acoustic sealant: in accordance with Section 07 92 00 - Joint Sealants.

.9 Polyethylene: to CAN/CGSB-51.34, Type 2.

.10 Insulating strip: rubberized, moisture resistant, 1/8 inch (3 mm) thick closed cell neoprene strip, 1/2 inch (12.7 mm) wide, with self-sticking permanent adhesive on one face, lengths as required.

.11 Joint compound: to ASTM C475, asbestos-free.

2.2 FINISHES

.1 Smooth finish: asbestos-free standard white texture coating and primer-sealer, recommended by gypsum board manufacturer.

.1 Primer: VOC limit 50 g/L maximum to GS-11.

PART 3 - EXECUTION

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Owner and Consultant.

.2 Inform Owner and Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Owner and Consultant.

3.2 ERECTION

.1 Do application and finishing of gypsum board to ASTM C840 except where specified otherwise.

.2 Do application of gypsum sheathing to ASTM C1280.

.3 Install work level to tolerance of 1:1200.

.4 Install wall furring for gypsum board wall finishes to ASTM C840, except where specified otherwise.

3.3 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.

.2 Apply layers gypsum board as indicated to metal furring or framing using screw fasteners. Maximum spacing of screws 12 inches (300 mm) on centre.

.3 Apply single layer gypsum board to concrete or concrete block surfaces, where indicated, using mechanical fasteners.

.1 Comply with gypsum board manufacturer's recommendations.

.2 Mechanically fasten gypsum board at top and bottom of each sheet.

.4 Apply 1/2 inch (13 mm) diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, and other penetrations, in partitions where perimeter sealed with acoustic sealant.

.5 Install gypsum board on walls vertically to avoid end-butt joints, except where local codes or fire-rated assemblies require horizontal application.

.6 Install gypsum board with face side out.

.7 Do not install damaged or damp boards.

.8 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 INSTALLATION

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 6 inches (150) mm on centre.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Construct control joints of back-to-back casing beads set in gypsum board facing and supported independently on both sides of joint.

.5 Provide continuous polyethylene dust barrier behind and across control joints.

.6 Locate control joints at approximate 30 feet (10 m) spacing on long corridor runs and at approximate 45 feet (15 m) spacing on ceilings.

.7 Install control joints straight and true.

.8 Construct expansion joints, at building expansion and construction joints. Provide continuous dust barrier.

.9 Install expansion joint straight and true.

.10 Splice corners and intersections together and secure to each member with 3 screws.

.11 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.12 Gypsum Board Finish: finish gypsum board walls to following levels in accordance with AWCI Levels of Gypsum Board Finish:

.1 Levels of finish:

.1 Level 0: (for temporary construction) no tapping, finishing or accessories required.

.2 Level 5: (for areas to receive gloss, semi-gloss, enamel, or non-textural flat paints) embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.

.13 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.14 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board to be invisible after surface finish is completed.

.15 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.16 Completed installation to be smooth, level, or plumb, free from waves and other defects and ready for surface finish.

.17 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.

.18 Mix joint compound slightly thinner than for joint taping.

.19 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations, or tool marks.

.20 Allow skim coat to dry completely.

.21 Remove ridges by light sanding or wiping with damp cloth.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

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

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

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by gypsum board assemblies' installation.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

.1 This Section includes the requirements for the supply and installation of all non-load-bearing steel stud framing members for the following applications:

.2 Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

.3 All requirements of Division 01 apply to this section and to be read in conjunction.

1.2 RELATED SECTIONS

.1 Joint Sealant ..... Section 07 92 00.

.2 Metal Doors and Frames ..... Section 08 11 00.

.3 Gypsum Board Assemblies..... Section 09 21 16.

1.3 REFERENCES

.1 Ontario 2012 Building Code.

.2 CSA S136 North American Specification for the Design of Cold-Formed Steel Structural Members

.3 ICC-ES-AC86, Acceptance criteria for Cold Formed Steel Framing Members – Interior Non-Loadbearing Wall Assemblies

.4 ASTM International:

.1 ASTM A641/A641M Standard Specification for Zinc-Coated (Galvanized), Carbon Steel Wire

.2 ASTM C645-11a, Standard Specification for Nonstructural Steel Framing Members.

.3 ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

.4 ASTM A792/A792M Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

.5 ASTM A1003 Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-coated for Cold-Formed Framing Members

.6 ASTM C754-11, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.7 ASTM C840 Standard Specification for Application and Finishing of Gypsum Board

.8 ASTM C1002 Standard Specification for Steel-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster bases to Wood Studs or Steel Studs

.9 ASTM E119-20 Standard Test Methods for Fire Tests of Building Construction and Materials

.10 ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions ad Elements

.11 ASTM E413 Classification for Rating Sound Insulation

.5 CAN/ULC S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials

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

.1 Material Safety Data Sheets (MSDS).

1.4 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit duplicate 12 inch (300 mm) long samples of non-structural metal framing.

1.5 QUALITY ASSURANCE

.1 Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load bearing interior steel framing, provide materials and construction identical to those tested in assembly indicated according to CAN/ULS-S101.

.2 STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413.

.3 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 DESIGN CRITERIA

.1 For Interior non-load bearing studs, conform to minimum design thickness:

.1 Web Depth: 92.1 mm (3.625 inch)

.2 Flange Width: 41.3 mm (1.625 inch)

.3 Base Steel Thickness: 0.455 mm (25 ga)

.2 A non-load bearing (non-structural) member is defined as a member in a steel-framed system which is limited to transverse (out-of-plane) load of not more than 480 PA, a superimposed axial load, exclusive of sheathing materials, of not more than 1460 N/m, or a superimposed axial load of not more than 890 N.

1.7 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Submit duplicate 12 inch (300 mm) long samples of non-structural metal framing.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

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

.2 Store and protect metal framing from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of packaging materials as specified in Construction Waste Management Plan.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

.1 Provide non-load bearing steel stud framing and accessories as manufactured by Bailey Metal Products or approved equal.

2.2 MATERIALS

.1 Non-load bearing Steel Framing, General

.1 Steel sheet components shall comply with ASTM C645 requirements for metal, unless otherwise indicated.

.2 Steel for non-load bearing members shall have metallic coatings that conform to ASTM A653M or ASTM A792M with minimum metallic coating weights (mass) of Z120 and AZM150 respectively. Alternative coatings shall be permitted to be used if proven to have equivalent corrosion protection.

.3 Framing members shall comply with the AISI North American Standard for Cold-Formed Steel Framing (Product Data) for conditions indicated.

.2 Suspension System Components

.1 Tie wire shall comply with ASTM A641/A641M zinc-coated, soft-annealed, 1.21 mm minimum diameter, or of a material and size having equivalent corrosion resistance and strength.

.3 Hanger wire shall comply with ASTM A641/A641M zinc-coated, soft-annealed, 3.77 mm minimum diameter, or of a material and size having equivalent corrosion resistance and strength.

.4 Carrying Channels

.1 Channels shall conform to ASTM C754 and shall be cold formed from steel with minimum 228 MPa yield strength and 1.37 mm base steel thickness.

.2 Channels shall have a minimum coating of Z120 galvanizing in accordance with ASTM A653/A653M. Other coatings (eg. Aluminum-zinc alloy to ASTM A792/A792M) providing Equal or better corrosion protection may also be used.

.3 Carrying channels shall have minimum 12.7 mm wide flanges and minimum depth of 38 mm.

.5 Furring Members

.1 Steel stud shall be manufactured from steel in accordance with the AISI North America Standard for Cold-Formed Steel Framing (Product Data) and shall have a minimum base Steel thickness of 0.455 mm and a depth of 92.1 mm.

.6 Steel Framing for Framed Assemblies

.1 Steel studs and track shall be in accordance with the AISI North American Standard for Cold-Formed Steel Framing (Product Data) and shall have minimum base steel thickness of 0.455 mm and a depth of 92.1 mm.

.2 Slip-Type Head Joints, provide one of the following:

.1 Deflection Track: steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than 0.455 mm for studs and width to accommodate depth of studs.

.2 Single Long-Leg Track: track complying with the AISI North American Standard for Cold-Formed Steel Framing (Product Data) with 50.8 mm deep flanges in thickness not less than indicated for studs, installed with studs frication-fit into top track and with continuous bridging located within 305 mm of the top studs to provide lateral bracing.

.3 Double-Track System: track complying with AISI North American Standard for Cold-Formed Steel Framing (Product Data), inside track with 50.8 mm deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction fit inside track.

.3 Flat Strap and Backing Plate

.1 Sheet steel for blocking and bracing in length and width to coordinate with equipment sizes.

.2 Minimum base steel thickness is 0.455 mm.

.4 Channel bridging shall comply with the AISI North American Standard for Cold-Formed Steel Framing (Product Data) and shall have a minimum base steel thickness of 0.455 mm with minimum 12.7 mm wide flanges and depth of 19.1 mm.

.7 Fasteners for Metal Framing: of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates in accordance with ASTM C1002.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Owner and Consultant.

.2 Inform Owner and Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Owner and Consultant.

3.2 PREPARATION

.1 Coordination with Sprayed Fire-Resistive Materials

.1 Where existing sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load bearing steel framing.

.2 Attach offset anchor plates or ceiling track to surfaces and reapply the same sprayed fire-resistive materials as existing or accepted alternative, to reinstate the existing fire rating of the assemblies.

.3 Do not reduce thickness of existing fire-resistive materials and protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION

.1 General

.1 Installation Standard:

.1 ASTM C754, except comply with framing sizes and spacing indicated.

.2 Gypsum Board Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.

.2 Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

.3 Attach gypsum board and/or exterior sheathing where noted, securely with tight fitting joints.

.4 Install bracing at terminations in assemblies.

.5 Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

.2 Installing Framed Assemblies

.1 Where studs are installed directly against dissimilar metals, install isolation strip between studs and dissimilar metals.

.2 Install studs so flanges within framing system point in same direction.

.1 Space studs vertically at 400 mm (16 inch) on centre and not more than 50 mm (2 inch) from abutting walls, and at each side of openings and corners.

.2 Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.3 Install track floors and overhead supports. Extend framing to 152 mm (6 inch) above suspended ceilings.

.4 Door Openings: screw vertical studs at jambs to jamb anchor clips to door frames; install track section (for cripple studs) at head and secure to jamb studs.

.1 Install two studs at each jamb, unless otherwise indicated.

.2 Install cripple studs at head adjacent to each jamb stud, with a minimum 12.7 mm (1/2 inch) clearance from jamb stud to allow for installation of control joint in finished assembly.

.3 Fire-Resistance-Rated Partitions: install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure. Attach studs to bottom and ceiling track using screws and crimp method.

.4 Sound-Rated Partitions: install framing to comply with sound-rated assembly indicated.

.5 Installation Tolerance: install each framing member so fastening surfaces vary not more than 3 mm (1/8 inch) from the plane formed by faces adjacent framing.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

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

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

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by non-structural metal framing application.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 The work of this section is for the requirements for heavy-duty, chemical resistant, electrostatic dissipative epoxy floor coating for the protection of interior concrete surfaces including concrete housekeeping pads.

.2 All requirements of Division 01 apply to this section and are to be read in conjunction.

1.2 RELATED SECTIONS

.1 Joint Sealants ..... Section07 92 00.

.2 Gypsum Board Assemblies..... Section 09 21 16.

1.3 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI/ESD STM97.1, ESD Association Standard Test Method For The Protection Of Electrostatic Discharge Susceptible Items - Floor Materials And Footwear - Resistance Measurement In Combination With A Person

.2 ANSI/ESD STM97.2, Floor Materials and Footwear – Voltage Measurement In Combination With A Person

.3 ANSI/ESD S7.1, Flooring Systems Resistive Characterization

.4 ANSI S20.20, Protection of Electrical and Electronic Parts

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

.1 ASTM A990/A990M, Standard Specification for Castings, Iron-Nickel-Chromium and Nickel Alloys, Specially Controlled for Pressure-Retaining Parts for Corrosive Service

.2 ASTM C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete

.3 ASTM D445, Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

.4 ASTM D570-95, Water Absorption of Plastics

.5 ASTM D638-M96, Tensile Properties of Plastics

.6 ASTM D696-91, Coefficient of Linear Thermal Expansion of Plastics between -30°C and 30°C

.7 ASTM D790-17, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

.8 ASTM D905-94, Strength Properties of Adhesive Bonds in Shear by Compression Loading

.9 ASTM D1044-94, Resistance of Transparent Plastic to Surface Abrasion

.10 ASTM D1308-87(1993)el, Effect of Household Chemicals on Clear and Pigmented Organic Finishes

.11 ASTM D1475, Standard Test Method for Density of Liquid Coatings, Inks, and Related Products

.12 ASTM D1652, Standard Test Method for Epoxy Content of Epoxy Resins

.13 ASTM D2240, Standard Test Method for Rubber Property - Durometer Hardness

.14 ASTM D2471, Standard Test Method for Gel Time and Peak Exothermic Temperature of Reacting Thermosetting Resins

.15 ASTM D4060-19, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser

.16 ASTM D4259, Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application

.17 ASTM D7234-21, Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers

.18 ASTM E84a-96a, Surface Burning Characteristics of Building Materials

.19 ASTM F150-06, Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring

.20 ASTM F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

.21 ASTM F2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

.3 Canadian General Standards Board (CGSB)

.1 CGSB 1-GP-71, Methods of Testing Paints and Pigments

.4 SOCIETY FOR PROTECTIVE COATINGS (SSPC)

.1 SSPC SP 6/NACE No.3, Commercial Blast Cleaning

1.4 SUBMITTALS

.1 Product Data: Submit manufacturer's technical data, installation instructions, and general recommendations for each resinous flooring material required. Include certification indicating compliance of materials with requirements.

.2 Samples:

.1 Submit, for verification purposes, 4-inch square samples of each type of resinous flooring required, applied to a rigid backing, in color and finish indicated.

.2 For initial selection of colors and finishes, submit manufacturer's color charts showing full range of colors and finishes available.

1.5 QUALITY ASSURANCE

.1 Single Source Responsibility: Obtain primary resinous flooring materials including primers, resins, hardening agents, finish or sealing coats from a single manufacturer with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Contractor shall have completed at least five projects of similar size and complexity; Stonhard or approved equal. Provide secondary materials only of type and from source recommended by manufacturer of primary materials.

.2 Pre-Installation Conference

.1 General contractor shall arrange a meeting not less than thirty days prior to starting work.

.2 Attendance:

.1 General Contractor

.2 Consultant

.3 Manufacturer/Installer's Representative

1.6 PRODUCT OPTIONS AND SUBSTITUTIONS

.1 Refer to Division 1 for requirements pertaining to product options and substitutions.

1.7 QUALIFICATIONS

The work of this Section shall be applied only by experienced applicators of the specified products.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Material shall be delivered to job site and checked by flooring contractor for completeness and shipping damage prior to job start.

.3 All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

.4 Material shall be stored in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained between 65 and 85ºF/18 and 30ºC.

.5 Deliver materials undamaged, in original containers, with manufacturer's labels and seals intact.

1.9 PROJECT CONDITIONS

.1 For interior coatings: Ensure minimum surface temperature 10°C 24 hours before, during and 24 hours after application or until cured; adequate controlled ventilation; bright, uniform lighting; broom clean; reasonably dust free.

.2 Utilities, including electric, water, heat (air temperature between 65 and 85ºF/18 and 30ºC) and finished lighting to be supplied by General Contractor.

.3 Job area to be free of other trades during, and for a period of 48 hours, after floor installation.

1.10 PROTECTION

.1 Protect adjacent surfaces from damage or overspray resulting from work of this Section. Mask and/or cover adjacent surfaces. Make good any damage at own expense, to the Minister's satisfaction.

.2 Post "Wet Coatings" and "No Smoking" signs, while work is in progress and curing.

1.11 WARRANTY

.1 Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of one (1) full year from date of installation. The electrostatic properties of the floor will remain under warranty for a period of five (5) full years from the date of installation.

PART 2 - PRODUCTS

2.1 EPOXY FLOORING MATERIALS

.1 Two-component, solvent-free and low-VOC containing, conductive epoxy primer and coating meeting the following minimum requirements:

Property	Test Method	Min. Requirement
Shore D Hardness	ASTM D2240	70
Tensile Strength	ASTM D638	15.50 MPa (2,250 psi)
Flexural Strength	ASTM D790	29 MPa (4200 psi)
Abrasion Resistance	ASTM D4060	65 mg (0.0023 oz)
Bond Strength	ASTM D4541	2.0 MPa (290 psi) Concrete failure
Electrostatic Behaviour	TR-53 - ANSI/ESD S7.1 / ASTM F150	$2.5 \times 10^4 – 1 \times 10^6$ ohms

.2 Acceptable products:

.1 SikaFloor-270 ESD by Sika Canada.

.2 MapeFloor System AS by Mapei Canada.

.3 StonLux ESD by Stonhard Inc.

2.2 EPOXY FLOORING COLOURS

.1 As selected by Consultant from manufacturer’s currently available standard colours

.2 Acceptable alternative: RAL 7038 Agate Grey.

2.3 WALL BASE MATERIALS

.1 For top set wall base: Provide 1/8 in. (3.2 mm) thick, 4 in. (10.16 cm) high colour-integrated wall base with a matte finish, conforming to ASTM F 1861, Rubber, Thermoplastic, Solid, Cove including premoulded end stops and external corners for coved base only, of colours selected by Owner and Consultant.

.1 Acceptable product: Armstrong or Johnsonite, Color-Integrated Vinyl Wall Base, Colour: as selected by Consultant from manufacturer’s currently available standard colours, or approved equivalent.

2.4 ACCESSORIES

.1 Provide reducing strips tapered to meet abutting materials:

.1 Carpet adaptor: Rubber Reducer.

.1 Acceptable product: Armstrong, Tarkett or Johnsonite.

.2 Colour: solid colour to be selected by Owner and Consultant from the currently available standard range.

.3 ADA-compliant profile.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine all surface conditions to which the work of this Section is to be applied. Report unacceptable surfaces to General Contractor and Consultant.

3.2 PREPARATION

.1 Substrate: Concrete preparation shall be by mechanical means and include use of a shot blast machine for removal of bond inhibiting materials such as curing compounds or laitance.

.2 Substrate: Concrete surface must be clean, dry, and sound. Remove dust, laitance, grease, oil, dirt, curing compounds, impregnations, waxes, foreign particles, coatings, and disintegrated particles by appropriate mechanical means, in order to achieve a profile equivalent to ICRI-CSP 3-4. Concrete compressive strength should be as directed by the manufacturer’s literature at the time of application.

3.3 APPLICATION

.1 General: Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic wearing surface of thickness indicated, uninterrupted except at divider strips, sawn joints or other types of joints (if any), indicated or required.

.2 Match finished work to approved samples. Maintain uniform thickness, sheen, colour, texture and free from defects detrimental to appearance of performance.

.3 Apply primer and coating as directed by the manufacturer’s literature.

.4 Grounding: Set ground plates in primer immediately after it is applied. They should be placed in close proximity to the grounding device (outlet, structural steel, conduit ordinance ground, etc.) There should be one ground per 1,000 sq.ft/93 sq.m or two per area less than 1,000 sq.ft/93 sq.m. The ground plates will be adhered to the substrate using the wet, conductive primer. Once the primer is tack free, it must be tested for proper conductivity (0.1 - 0.9 megohms) prior to base installation.

.5 Base: Mix base material according to manufacturer's recommended procedures. Uniformly spread mixed material over previously primed and sealed substrate using manufacturer's specially designed rake. Roll material using manufacturer's specially designed roller. Strict adherence to manufacturer's installation procedures and coverage rates is required.

.6 Limitations: as directed by the manufacturer’s literature.

.7 Cured thickness of applied material: Minimum 3 mm.

3.4 ELECTRICAL TESTING

.1 The purpose of these tests is to ensure the quality and consistency of the electrical properties of the flooring system. Testing will utilize the following:

.1 All test equipment must be labeled with a recent calibration date by a standards lab. Date must be within the last 12 months.

.2 All electrical tests will be made in accordance with ASTM F150, ANSI ESD Assoc. S7.1.

.3 All electrical test results will be recorded on a Static Control Flooring Report.

.2 Electrical testing: Prior to performing tests prepare a diagram of the entire area. Divide diagram into 1,000 sq.ft. grids. Number or letter the grids to give discrete identity to each 1,000 sq.ft. area. Prepare a static control flooring report summary for the entire area. (Average measurements for each 1,000 sq.ft. area will be recorded on this form) Prepare area diagrams for each 1,000 sq.ft. area. (All measurements will be recorded on this diagram.) Label each diagram with its corresponding grid location.

.3 Overlayment testing: After the flooring system has cured a minimum of 48 hours the floor must be conditioned using a megohmeter (high range ohm meter) at 1,000 volts along with two 20" long squeegee type probes placed 2 inches apart. After being conditioned, measure surface resistance using ASTM & ESD test equipment and procedures. A minimum of 10 measurements must be taken for every 1,000 sq.ft. area. Record all results on the test reports. Any areas not within these specifications must be re-tested to evaluate the size of the affected area. Out of spec areas must be reconditioned and re-tested.

3.5 FIELD QUALITY CONTROL

.1 The right is reserved to invoke the following material testing procedure at any time, and any number of times during period of flooring application.

.2 The Owner will engage service of an independent testing laboratory to sample materials being used on the job site. Samples of material will be taken, identified and sealed, and certified in presence of Contractor.

.3 Testing laboratory will perform tests for any of characteristics specified, using applicable testing procedures referenced herein, or if none referenced, in manufacturer's product data.

.4 If test results show materials being used do not comply with specified requirements, Contractor may be directed by Owner to stop work; remove non-complying materials; pay for testing; reapply flooring materials to properly prepared surfaces which had previously been coated with unacceptable materials.

3.6 CURING, PROTECTION AND CLEANING

.1 Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 48 hours.

.2 Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

.3 Cleaning:

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

.2 Promptly, as the work proceeds and upon completion, clean up excess materials and rubbish.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

.1 Section Includes:

.1 The work of this section is for the painting and finishing of all areas as the Contract drawings and specifications, but not limited to the following surfaces: drywall, and metal door frames.

.2 All requirements of Division 01 apply to this section and are to be read in conjunction.

1.2 RELATED SECTIONS

.1 Joint Sealants..... Section 07 92 00.

.2 Hollow Metal Doors and Frames..... Section 08 11 00.

.3 Gypsum Board Assemblies..... Section 09 21 16.

1.3 REFERENCES

.1 CAN/CGSB-1.57, Interior Alkyd Semigloss Enamel.

.2 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.

.3 CAN/CGSB-1.100, Interior Flat Latex Paint.

.4 CAN/CGSB-1.119, Interior Latex Primer-Sealer.

.5 CAN/CGSB-1.188, Emulsion Filler for Masonry Block.

.6 CAN/CGSB-1.195, Interior Latex Semigloss Paint.

.7 CAN/CGSB 85-GP-10M, Protective Coating for Metals.

.8 CAN/CGSB 85-GP-100M, Painting.

.9 Canadian/Ontario Painting Contractors' Association (CPCA/OPCA) Painting Specification Manual.

.10 Environmental Protection Agency (EPA)

.1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - [1995], (for Surface Coatings).

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

.1 Material Safety Data Sheets (MSDS).

.12 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual, 2004.

.13 National Fire Code of Canada - 2010

.14 Society for Protective Coatings (SSPC)

.1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Conform to the standards contained in the MPI Manual.

.1 Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and as follows:

.1 Have a minimum of five (5) years proven satisfactory experience and shall show proof before commencement of work that he will maintain a qualified crew of painters throughout the duration of the work.

.2 When requested provide a list of the last three comparable jobs including, name and location, specifying authority, start and completion dates and cost amount of the painting work.

.3 Only qualified journeymen who have a Tradesman Qualification Certificate of Proficiency shall be engaged in painting and decorating work.

.4 Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.2 Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats and as follows:

.1 Use only paint manufacturers and products as listed under the Approved Products section of the MPI Manual Architectural Painting Specification Manual.

.3 Mock-Ups:

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

.1 Provide 6’-0” x 6’-0” mock-up. Prepare and paint designated surface, area, room or item (in each colour scheme) to specified requirements, with specified paint or coating showing selected colours, gloss/sheen, and textures.

.2 Mock-up will be used:

1. To judge workmanship, substrate preparation, operation of equipment and material application and workmanship to MPI Architectural Painting Specification Manual standards.

.3 Locate where directed. Allow 24 hours for inspection of mock-up before proceeding with work.

.4 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may not remain as part of finished work. Remove mock-up and dispose of materials when no longer required and when directed by Owner and Consultant.

.4 Pre-Installation Meeting:

.1 Convene pre-installation meeting one week prior to beginning work of this Section on-site installations.

.2 Verify project requirements.

.3 Review installation and substrate conditions.

.4 Coordination with other building subtrades.

.5 Review manufacturer's installation instructions and warranty requirements.

1.5 SCHEDULING

.1 Submit work schedule for various stages of painting to Owner and Consultant for review. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Owner and Consultant for changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants.

1.6 SUBMITTALS

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

.2 Product Data:

.1 Submit product data and instructions for each paint and coating product to be used.

.2 Submit product data for the use and application of paint thinner.

.3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application and curing.

.3 Samples:

.1 List of Materials - A list of materials proposed for use on the work, prepared by the paint manufacturer, shall be submitted in writing to the Consultant for approval at least thirty (30) days before the materials are required. The list shall bear the manufacturers official certification that the materials listed thereon are the best quality made by the company.

.2 Submit full range colour sample chips to indicate where colour availability is restricted.

.3 Provide three (3) 12" x 12" colour samples of each type of finish specified with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:

.1 1/8 inch plate steel for finishes over metal surfaces.

.2 1/2 inch gypsum board for finishes over gypsum board and other smooth surfaces.

.4 Submit samples to Consultant for acceptance. Clearly identify colour samples with location of intended application.

.5 Retain accepted colour and finish samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.6 Test reports: submit certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.1 Lead, cadmium and chromium: presence of and amounts.

.2 Mercury: presence of and amounts.

.3 Organochlorines and PCBs: presence of and amounts.

.7 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.8 Manufacturer's Instructions:

.1 Submit manufacturer's installation [application] instructions.

.9 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour numbers.

.4 MPI Environmentally Friendly classification system rating.

1.7 MAINTENANCE

.1 Extra Materials:

.1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.

.2 Quantity: provide four litres can of each type and colour of primer stain and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Delivery, storage, and protection: comply with Owner and Consultant requirements for delivery and storage of extra materials.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Pack, ship, handle, and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.

.2 Acceptance at Site:

.1 Identify products and materials with labels indicating:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened, and rejected materials from site.

.4 Storage and Protection:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store materials and supplies away from heat generating devices.

.3 Store materials and equipment in well-ventilated area with temperature range 7 degrees C to 30 degrees C.

.5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning, and preparation clean and orderly. After completion of operations, return areas to clean condition.

.7 Remove paint materials from storage only in quantities required for same day use.

.8 Fire Safety Requirements:

.1 Provide one 20 lbs. (9 kg) capacity CO_2 fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers, and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

.9 Waste Management and Disposal:

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

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

.3 Collect and separate for disposal all packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).

.4 Separate for recycling and place in designated containers Metal and Plastic waste in accordance with Waste Management Plan (WMP).

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with Regional and Municipal, regulations.

.7 Ensure emptied containers are sealed and stored safely.

.8 Unused paint and coating materials must be disposed of at official hazardous material collections site as approved by Owner and Consultant.

.9 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.10 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.11 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.12 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil-soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.13 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.14 Set aside and protect surplus and uncontaminated finish materials: Deliver to or arrange collection by employees, individuals, or organizations for verifiable re-use or re-manufacturing.

1.9 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces remove odours, evaporating solvents and moisture.

.2 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Provide continuous ventilation for seven days after completion of application of paint.

.4 Coordinate use of existing ventilation system with Owner and ensure its operation during and after application of paint as required.

.5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.6 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless pre-approved written approval by and product manufacturer, perform no painting when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is under 85% or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.

.5 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.

.2 Perform painting work when maximum moisture content of the substrate is below:

.1 12% for plaster and gypsum board.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Additional interior application requirements:

.1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Owner and Consultant such that painted surfaces will have dried and cured sufficiently before occupants are affected.

1.10 WASTE MANAGEMENT

.1 Do not dispose of paints or solvents by pouring on the ground.

.2 Empty paint cans are to be dry prior to disposal.

.3 Solvent based paints, wood preservatives, stains, and finishes, which cannot be reused, must be treated as hazardous waste, and disposed of in an appropriate manner in accordance with hazardous waste regulations.

1.11 WARRANTY

.1 Provide a written warranty for painting specified in this section as per the Contract, including materials and application, at no cost to the Owner.

.2 The Contractor shall warrant that the painting will be free of defects related to workmanship and/or material deficiency. The following shall be specifically covered under the warranty: scaling, crazing, cracking, crumbling, bubbling, shrinkage, running, sagging, change of colour, loss of adhesion, loss of cohesion and staining of adjoining or adjacent materials or surfaces.

.3 Correct deficiencies immediately. Any repair(s) required under the warranty shall be carried out in accordance with the requirements of this Specification and with the recommendations of the Consultant.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Provide paint materials for paint systems from single manufacturer.

.3 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this project.

.4 Conform to latest MPI requirements for interior painting work including preparation and priming.

.5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.6 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

.7 Provide paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels.

.8 Use MPI listed materials having minimum E2 rating where indoor air quality (odour) requirements exist.

.9 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:

.1 Water-based.

.2 Non-flammable and biodegradable.

.3 Manufactured without compounds which contribute to ozone depletion in the upper atmosphere.

.4 Manufactured without compounds which contribute to smog in the lower atmosphere.

.5 Do not contain methylene chloride, chlorinated hydrocarbons, and toxic metal pigments.

.10 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium, or their compounds.

.11 Flash point: 61.0 degrees C or greater for water-borne surface coatings and recycled water-borne surface coatings.

.12 Ensure manufacture and process of both water-borne surface coatings and recycled water-borne surface coatings does not release:

.1 Matter in undiluted production plant effluent generating 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to natural watercourse or sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to natural watercourse or a sewage treatment facility lacking secondary treatment.

.13 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.

.14 Recycled water-borne surface coatings to contain 50 % post-consumer material by volume.

.15 Recycled water-borne surface coatings must not contain:

.1 Lead in excess of 600.0 ppm weight/weight total solids.

.2 Mercury in excess of 50.0 ppm weight/weight total product.

.3 Cadmium in excess of 1.0 ppm weight/weight total product.

.4 Hexavalent chromium in excess of 3.0 ppm weight/weight total product.

.5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

2.2 COLOURS

.1 Submit proposed Colour Schedule to Owner and Consultant for review.

.2 Colour schedule will be based upon selection of five base colours and three accent colours. No more than eight colours will be selected for entire project and no more than three colours will be selected in each area.

.3 Selection of colours from manufacturers’ full range of colours.

.4 Where specific products are available in restricted range of colours, selection based on limited range.

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

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. Obtain written approval from Owner and Consultant for tinting of painting materials.

.2 Mix paste, powder, or catalyzed paint mixes in accordance with manufacturer's written instructions.

.3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.4 Thin paint for spraying in accordance with paint manufacturer's instructions.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

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

.1 G3 - Eggshell: Low sheen finish with a gloss range of 10 to 35 when measured at 85 to meter and 10 to 25 when measured at 60.

.2 Galvanized metal: Metal Door Frames.

.1 INT 5.3K - Waterborne light industrial semi-gloss level coating (over waterborne primer).

.3 Dressed Lumber: Flush Wood Doors.

.1 INT 6.3A – High performance architectural latex semi-gloss level finish.

.2 INT 6.3S – Fire retardant, clear finish (ULC rated).

.4 Plaster and gypsum board: gypsum board, drywall, sheet gypsum material.

.1 INT 9.2B - High performance architectural latex semi-gloss level finish.

.2 INT 9.2M - Institutional low odour/low VOC semi-gloss level finish.

2.5 MECHANICAL, ELECTRICAL AND FIRE PROTECTION/ALARM EQUIPMENT

.1 Leave equipment, panels and cabinets in original finish except for touch up as required, and paint exposed conduits, exposed mounting accessories and other exposed unfinished items.

2.6 SOURCE QUALITY CONTROL

.1 Perform following tests on each batch of consolidated post-consumer material before surface coating is reformulated and canned. Testing by laboratory or facility which has been accredited by Standards Council of Canada.

.1 Lead, cadmium, and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.

.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.

.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Owner and Consultant damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:

.1 Stucco, plaster, and gypsum board: 12%.

.2 Wood: 15%.

3.4 PREPARATION

.1 Protection:

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Owner and Consultant.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect building occupants and visitors in and about the building.

.2 Surface Preparation:

.1 Remove electrical cover plates, light fixtures, surface hardware on doors, toilet accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.

.2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Owner and Consultant.

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

.1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil, and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

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

.5 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 3’-0”.

.6 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease, and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets, and corners to be painted by brushing with clean brushes blowing with clean dry compressed air vacuum cleaning.

.7 Touch up of shop primers with primer as specified.

.8 Do not apply paint until prepared surfaces have been accepted by Owner and Consultant.

3.5 APPLICATION

.1 Method of application to be as approved by Owner and Consultant. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in uniform layer using brush and/or roller type suitable for application.

.2 Work paint into cracks, crevices, and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers, or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.

.4 Brush out immediately all runs and sags.

.5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins, or daubers only when no other method is practical in places of difficult access.

.5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.9 Finish alcoves as specified for adjoining rooms.

.10 Finish top, bottom, edges, and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL, ELECTRICAL AND FIRE PROTECTION/ALARM EQUIPMENT

.1 Paint finished area exposed conduits, piping, hangers, ductwork, and other unfinished mechanical and electrical equipment and fixtures with colour and finish to match adjacent surfaces, except as indicated.

.2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.3 Do not paint over equipment and fixtures nameplates.

.4 Keep sprinkler heads free of paint.

.5 Paint inside of ductwork where visible behind grilles, registers, and diffusers with primer and one coat of matt black paint.

.6 Paint fire protection piping red.

.7 Paint natural gas piping yellow.

.8 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.9 Do not paint interior transformers and substation equipment.

3.7 SITE TOLERANCES

.1 Walls: no defects visible from a distance of 3’-0” at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 FIELD QUALITY CONTROL

.1 Interior painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.

.2 Interior surfaces requiring painting shall be inspected by Paint Inspection Agency who shall notify Owner and Consultant and General Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.

.3 Where "special" painting, coating, or decorating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer shall provide as part of this work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Owner and Consultant.

.4 Standard of Acceptance:

.1 Walls: no defects visible from a distance of 3’-0” at 90 degrees to surface.

.2 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

.5 Field inspection of painting operations to be carried out by independent inspection firm as designated by Owner and Consultant.

.6 Advise when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.7 Cooperate with inspection firm and provide access to areas of work.

.8 Retain purchase orders, invoices, and other documents to prove conformance with noted MPI requirements when requested by Owner and Consultant.

3.9 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Post wet paint signs during drying and restrict or prevent traffic where necessary.

.4 Identify wet paint areas with signs until paint is completely dry.

.5 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.6 Protect freshly completed surfaces from paint droppings and dust to approval of Owner and Consultant. Avoid scuffing newly applied paint.

.7 Restore areas used for storage, cleaning, mixing, and handling of paint to clean condition as approved by Owner and Consultant.

.8 Follow paint manufacturer's recommendations for safety precautions. Ensure workers and general public are adequately protected during storage, handling, application and drying periods.

.9 Post sign, after Consultant's inspection and acceptance of each room, reading: PAINTING COMPLETE - NO ADMITTANCE WITHOUT CONTRACTOR'S PERMISSION.

.10 Daily as the work proceeds and upon completion, remove all surplus materials and debris resulting from work of this section.

.11 Upon conclusion of the work, remove all materials and debris connected with the work and leave the premises neat, clean and in condition equivalent to that when work was begun.

3.10 MAINTENANCE MATERIALS

.1 Deliver to the Owner sufficient material to produce at least 4.5 L (1 Imp. Gal.) of paint of each colour and finish used on exterior and interior surfaces after the project is completed.

END OF SECTION

MECHANICAL SPECIFICATIONS

PART 1 - GENERAL

1.1 GENERAL CONTRACT DOCUMENTS

Comply with General Conditions of Contract, Supplementary Conditions and Division 1 - General Requirements.

1.2 DOCUMENT ORGANIZATION

1. Applicable Divisions for Mechanical Work:
   - .1 Division 20 - Common Work for Mechanical
   - .2 Division 21 - Fire Protection
   - .3 Division 23 - Heating, Ventilation and Air Conditioning (HVAC)
   - .4 Division 25 - Building Automation System
2. The Specifications for these Divisions are arranged in Sections for convenience. It is not intended to recognize, set or define limits to any subcontract or to restrict Contractor in letting subcontracts.
3. Contractor is responsible for completion of work whether or not portions are sublet.

1.3 DIVISION 20, AS IT APPLIES TO DIVISIONS 21, 23 AND 25

1. Articles that are of a general nature, applicable to each Section of these Divisions.
2. Articles specifying materials, equipment, installation techniques and workmanship that are applicable to more than one Section of these Divisions.
3. Articles that are to be read in context with and form part of relevant Sections of these Divisions.

1.4 EQUIPMENT

1. Manufacturers' Nameplates:
   - .1 Provide metal nameplate with raised or recessed lettering, mounted on each piece of equipment.
   - .2 On insulated equipment, mechanically fasten plates on metal stand-off bracket arranged to clear insulation and mount Underwriters Laboratories and/or CSA registration plates on same stand-off brackets.
   - .3 Manufacturer's nameplate to indicate equipment size, capacity, model designation, manufacturer's name, serial number, voltage, cycle, phase and power rating of motors.
2. Factory-applied Finish Painting
   - .1 Apply prime and final paint coats to equipment and materials where specifically detailed in Sections of these Divisions.
   - .2 Apply prime and final paint coats factory to pumps, air moving units, un-insulated pressure vessels and bare metal equipment items in boiler, mechanical and fan rooms.
   - .3 Use heat resistant paint where conditions require
   - .4 Protect factory finished equipment during construction, and clean at completion of work.

3. Factory-applied Prime Painting: Have prime paint factory applied to other equipment fabricated from iron or steel including access doors, registers, grilles, diffusers, dampers, metal radiation enclosures and fire hose cabinets.

4. Field Painting

   .1 After equipment has been installed and piping and insulation is completed, clean rust and oil from exposed iron and steel work provided under this Division, whether or not it has been factory prime painted.

   .2 In "occupied" areas of building touch up any damage to prime coat resulting from shipping or installation and leave ready for final painting under Finishes, Division 9.

   .3 In "un-occupied" areas of the building such as mechanical equipment rooms, boiler rooms, fan rooms, crawl spaces, pipe tunnels and penthouses:

      .1 paint exposed galvanized metal surfaces with one coat of zinc dust galvanized primer and one coat of 100% Alkyd base enamel in an approved colour.

      .2 paint exposed iron or steel work with one coat of chrome oxide phenolic base primer and one coat of 100% Alkyd base enamel in an approved colour.

5. Maintenance of Bearings.

   .1 "Turn over" rotating equipment at least once a month from delivery to site until start-up.

   .2 Protect bearings, shafts and sheaves against damage, corrosion and dust accumulation during building construction.

1.5 CO-ORDINATION

1. General

   .1 Consultant drawings are diagrammatic and illustrate the general location of equipment, and intended routing of ductwork, piping, etc, and do not show every structural detail. In congested areas drawings at greater scale may be provided to improve interpretation of the Work.

   .2 Lay out and coordinate Work to avoid conflict with work under other Divisions.

   .3 Make good all damage to Owner's property or to other trade's work caused by inaccurate layout or careless performance of work of this Division.

   .4 When equipment provided under other Sections connects with material or equipment supplied under this Section, confirm capacity and ratings of equipment being provided. Section 20 is intended to define and take all the responsibilities for coordination with all other sections.

   .5 Take information involving accurate measurements from dimensioned Architectural Drawings or at building.

   .6 Install services and equipment which are to be concealed, close to building structure so that furring is kept to minimum dimensions.

   .7 Location of pipes, ductwork, raceways, and equipment may be altered without extra cost provided instruction is given or approval is obtained, in advance of installation of items involved. Changes will be authorized by site instructions and are to be shown on Record Drawings.

   .8 Location of floor drains, hub drains, combination drains, plumbing fixtures, convectors, unit heaters, diffuser, registers grilles and other similar items may be altered without extra cost provided instruction is given prior to roughing in. No claim will be paid for

extra labour and materials for relocating items up to 3 m (10 ft) from original location nor will credits be anticipated where relocation up to 3 m (10 ft) reduces material and labour.

.9 Include incidental material and equipment not specifically noted on Drawings or mentioned in Specifications but which is needed to complete the work as an operating installation.

1.6 OPERATING AND MAINTENANCE INSTRUCTIONS

1. Start-up and Testing: Supply services of skilled mechanic for minimum of two consecutive days, to start systems in proper sequence, and test and calibrate controls, instrumentation and valves and dampers and to set-up systems.

2. Training:

   .1 During this procedure thoroughly explain operation and maintenance of each system, incorporating specialized instruction by manufacturers as described under other Sections in these Divisions.

   .2 Arrange suitable time for instructions with Owner's operating and maintenance personnel.

   .3 Keep record of date and duration of each instruction period together with names of persons attending. Submit signed records at completion of instruction.

3. Operating and Maintenance Manuals: Provide operation and maintenance data bound in 210 mm x 300 mm x 50mm thick (8½ in x 11 in x 2 in thick) size, vinyl covered, hard back, three-ring covers. Organize material in volumes generally grouped by Trade Section: Plumbing, Fire Protection, Heating and Cooling Plant and Distribution, Air Handling, and Controls and Instrumentation, Title sheet in each volume to be labeled "Operating and Maintenance Manual" and to bear Project Name, Project Number, Date, Trade Section, and List of Contents.

   .1 Operating data to include:

      .1 Control schematics for each system.

      .2 Description of each system and associated control elements.

      .3 Control operating sequences at various load conditions, reset schedules and anticipated seasonal variances.

      .4 Operating instructions for each system and each component.

      .5 Description of actions to be taken in event of equipment failure.

      .6 Valves schedule and flow diagram.

      .7 Service piping identification chart.

   .2 Maintenance data to include:

      .1 Manufacturer's literature covering, servicing, maintenance, operating and trouble-shooting instructions for each item of equipment.

      .2 Manufacturer's parts list.

      .3 Approved shop drawings.

      .4 Name and address of closest service organization and spare part source.

      .5 Equipment manufacturer's performance sheets.

      .6 Equipment performance verification test results.

      .7 Voltage and ampere rating for each item of electrical equipment.

   .3 Approval procedure

.1 Submit two sets of first draft of Operating and Maintenance Manuals for approval.

.2 Make corrections and resubmit as directed.

.3 Review contents of Operating and Maintenance Manuals with Owner's operating staff or representative to ensure thorough understanding of each item of equipment and its operation.

.4 Hand-over two copies of Operating and Maintenance Manuals to Owner's operating staff and obtain written confirmation of delivery.

4. Special Tools and Spare Parts

.1 Furnish spare parts as follows:

.1 One set of V-belts for each drive.

.2 One filter cartridge or set of filter media for each filter or filter bank installed.

1.7 QUALIFICATIONS AND AUTHORITIES

1. Scope

.1 Qualification requirements for tradesmen in the province of Ontario.

.2 Registration and inspection of systems.

2. Qualifications

.1 Trades Qualification and Apprenticeship Act

.1 Tradesmen to hold certification of applicable trades:

.1 Plumber, O.Reg. 1073

.2 Refrigeration and air-conditioning mechanic, O.Reg. 75/05

.3 Sprinkler and fire protection installer, O.Reg. 1078

.2 Technical Standards and Safety Authority Act 2000

.1 Manufacturers and installers of regulated pressure piping parts and systems regulated to hold certificates of authorization under Boilers and Pressure Vessels O.Reg. 220/01, for;

.1 pressure piping systems, CSA B51 Boiler, Pressure Vessel and Pressure Piping Code

.2 refrigeration piping systems, CSA B52 Mechanical Refrigeration Code

Arrange, provide documentation, and pay for registration and inspection of the pressure piping.

PART 2 PRODUCTS

2.1 PIPING IDENTIFICATION

Manufactured identification systems:

.1 laminated vinyl or polyester,

.2 resistant to chemical, ultraviolet,

.3 minimum operating temperature: -25 degrees C (-12 degrees F)

.4 maximum operating temperature: 60 degrees C (140 degrees F)

.5 Standard of Acceptance

.1 Brady - identification tapes, bands, and markers.

.2 Seton - Setmark Pipe Markers.

.3 Smillie McAdams Summerlin.

.4 Craftmark Identification Systems.

2.2 EQUIPMENT IDENTIFICATION NAMEPLATES

1. Identification plates are in addition to manufacturers plates.

Identification plates:

.1 provided for equipment identified with number designations in schedules and equipment selection sheets.

.2 marked with equipment type, number and service following wording and numbering used in contract documents.

laminated plastic

white face and black centre

minimum size 90 mm x 40 mm x 2.5 mm (3 in x 1½ in x 1/10 in),

engraved with 10mm (1/2 in) high lettering.

2.3 PIPING IDENTIFICATION

1. Flexible coil-wrap manufactured markers:

.1 plastic coated markers with integral printing, or

.2 plastic cover with field applied self-adhesive markers

.3 applicable WHIMS pictogram for identification of material hazard

2.4 IAQ PRODUCTS DURING CONSTRUCTION

1. Temporary Filters

.1 50 mm (2 in) thick, disposable panel filters, maximum 2.5 m/s (500 fpm) face velocity.

.2 Minimum Efficiency Reporting Value (MERV) : 8.

2. Cleaning Agents: Low Volatile Organic Compound (VOC) type.

2.5 IAQ PRODUCTS FOR PRE-OCCUPANCY

1. Filters: In accordance with relevant specifications for air handling systems and air filters.

PART 3 EXECUTION

3.1 PIPING IDENTIFICATION

Provide manufactured tape markers:

.1 flexible coil-wrap on outdoor piping

.2 Install markers on cleaned and prepared surfaces.

Locations:

.3 maximum every 15m (50 ft) along length of pipe

.4 before and after barriers, floors and walls,

.5 within 1 m (3 ft) of and behind access doors ,

.6 within 1 m (3 ft) of piping termination point.

3.2 PIPE IDENTIFICATION CLASSIFICATION

1. Use existing coding system for building additions and alterations.

3.3 APPLICATION OF INSULATION TO PIPE AND FITTINGS

1. Straight pipe sections:
   - .1 Locate insulation joints and cover seams in least visible locations; stagger adjacent longitudinal seams.
   - .2 Secure pipe insulation with bands or vapour barrier tape at centre of each section and at each end and at not more than 900 mm (3 ft) intervals.
   - .3 Elastomeric closed cell insulation self-adhered or provide 100% coverage of contact adhesive.
2. Elbows:
   - .1 Use mitred segments of insulation at pipe elbows and wrap joints with vapour barrier tape.
   - .2 Number of mitred segments to be sufficient to maintain thickness of insulation around throat of elbow.
   - .3 Finish elbows with jacket of same material as rest of piping system.
3. Fittings, valves, strainers, and joints
   - .1 Where phenolic or elastomeric insulation is used:
     - .1 Provide insulation, mitred, cut and glued, to cover fittings, valves and strainers from flange to flange or coupling to coupling.
     - .2 Secure insulation by banding and tape ends to adjacent pipe covering with vapour barrier tape.
   - .2 Finish with same material as used for pipe.
4. Hangers and supports:
   - .1 Cold and dual temperature pipe: steel piping all sizes, and other piping of copper or plastic NPS 1½ or larger:
     - .1 provide inserts between insulation protection shields and pipe at each hanger or support,
     - .2 install insulation protection shields between hanger and insulation

3.4 IAQ DURING CONSTRUCTION

2. HVAC Protection – Non-operating Systems
   - .1 For common air handling systems serving construction space and occupied spaces outside the construction zone, close balancing dampers serving the construction zone after marking or recording as-found position of damper operator.
   - .2 Seal off non-operating return and exhaust ductwork openings, and grilles with 6 mil plastic, securely taped to sides of duct.
3. HVAC Protection – Operating Systems
   - .1 Application: return air systems that operate and serve the construction zone, including fans used to control air pressure in the construction zone.
     - .1 Install temporary filters at return air inlets.

.2 For ducted return systems, provide temporary filters at each return air grille or opening, secured in place with tape.

.3 For ceiling plenum return systems:

.1 operate return air systems only while ceiling system is in place,

.2 remove open-end-duct transition piece, and install temporary filter plenum.

.4 Temporary filter plenum construction:

.1 front load filter panel frame and retention clips

.2 maximum filter face velocity : 2.5 m/s (500 fpm)

.3 maximum transition angle: 45 degrees

.4 temporary filters MERV 8.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL

.1 Provide dry pipe pre-action sprinkler system as shown.

.2 Provide installation drawings and hydraulic calculations, designed and sealed by a professional engineer licensed in the province of Ontario.

1.2 DESCRIPTION OF WORK

.1 Fire protection work includes:

.1 Combination Dry Pipe and Pre action Sprinkler System

.2 Commissioning Of Fire Protection Systems,

.3 Fire Extinguishers

.2 Provide combination Dry-Pipe and Pre-action Systems as shown with header assembly, piping, supervised valves, flow switches, fire department connection, compressed air supplies and fire alarm system interface.

1.3 APPLICABLE CODES AND STANDARDS

.1 National Fire Protection Association (NFPA) 10 – Standard for Portable Fire Extinguishers

.2 National Fire Protection Association (NFPA) 13 – Standard for the Installation of Sprinkler Systems

.3 National Fire Protection Association (NFPA) 25 – Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems

.4 Ontario Fire Code

.5 Ontario Building Code

1.4 ENGINEERING DESIGN CRITERIA

.1 System is existing. Modify as shown to ensure proper coverage.

.2 Design system in accordance with ANSI/NFPA 13, using following parameters:

.1 Hazard: To suit occupancy as indicated on drawing M-03

.2 Pipe size and layout: To be designed using hydraulic design methods

.3 Sprinkler head layout: To ANSI/NFPA 13 or as directed by authorities having jurisdiction. Sprinkler head layouts shown on M-03 are indicative only for the purposes of pricing and establishing scope.

.4 Hydraulic Calculations: Prepare and submit hydraulic calculations to the Fire Department and the Owner for review.

.5 Design densities

.1 Light hazard 0.1 GPM/ft^2

.2 Ordinary hazard 0.15 GPM/ft^2

.6 Zoning: System zoning as indicated.

1.5 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01.

.2 Provide spare sprinklers and tools as required by ANSI/NFPA 13.

1.6 SHOP DRAWINGS AND PRODUCT DATA

.1 After shop drawings are accepted by reviewing Authority submit copies of these stamped shop drawings and product data sheets for review in conformity with Division 1 procedures.

- .1 Product Data: Provide manufacturer's printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.
  - .2 Shop drawings to include:
    - .1 Piping and sprinkler layout.
    - .2 Seismic bracing locations to be indicated.
    - .3 Types of sprinklers with information on:
    - .4 Orientation (upright, pendant, semi-recessed, concealed, etc.).
    - .5 K-factor.
    - .6 Response Time Index.
    - .7 Temperature rating.
- .3 Hydraulic calculations.
- .4 Cutsheets and product data sheets for each component, at minimum:
  - .1 Piping and flex connections
  - .2 Fittings
  - .3 Couplings
  - .4 Sprinklers
  - .5 Escutcheon plates
  - .6 Hangers and braces
  - .7 Valves
  - .8 Gauges
  - .9 Accelerators/quick opening devices
  - .10 Drum drips/auxiliary drains.
- .5 Indicate:
  - .1 Materials
  - .2 Finishes
  - .3 Method of anchorage
  - .4 Number of anchors
  - .5 Supports
  - .6 Reinforcement
  - .7 Assembly details
  - .8 Accessories.

1.7 MAINTENANCE MATERIALS

.1 Provide cabinet, containing special sprinkler wrench, and spare stock of sprinklers. Include at least one head of each type and temperature rating installed in system.

.2 Test reports: Submit certified test reports for sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.3 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Manufacturers' Instructions: Provide manufacturer's installation instructions.

.5 Field Quality Control Submittals: Manufacturer's Field Reports: manufacturer's field reports specified.

PART 2 PRODUCTS

3.1 SPRINKLER HEADS

.1 Sprinkler heads to be listed Dry-upright heads or wet concealed pendent heads. Standard of Acceptance

.1 Viking

.2 Tyco

.3 Reliable

3.2 PIPE, HANGERS, AND GASKETS

.1 Pipe, galvanized for Dry Pipe & Pre-Action system piping:

.1 ASTM A53 Grade B, Schedule 40 continuous weld steel to up to NPS 2, grooved

.2 NPS 2½ and over ASTM A53-72A Schedule 10 thin wall, rolled grooved.

.2 Pipe hangers:

.1 UL/ULC listed for fire protection, and

.2 swivel ring hanger type

.3 Gaskets for flanged joints: Red rubber sheet 1.6 mm (1/16 in) thick. Standard of Acceptance: Chesterton 100 or Beldam Red Rubber

3.3 FITTINGS FOR GROOVED PIPE TO 1200 KPA (175 PSI)

.1 Couplings: Malleable or ductile iron NPS 2½ and over.

.2 Fittings: Malleable iron or ductile iron to NPS 2½ to NPS 12.

.3 Flanges: Cast iron, raised face flange with coupling groove NPS 2½ and over.

.4 Gaskets for grooved couplings: EPDM Grade "E", dry lubricated.

3.4 PRE-ACTION SYSTEM TYPE

.1 Double-interlocked, single-zoned, electric/pneumatic release. Firefelx TotalPac3 or equivalent.

3.5 PACKAGED PRE-ACTION SYSTEM

.1 Deluge valves c/w supervised butterfly control valve, releasing trim rated at 250 psi and all the necessary accessories. Trim shall include a mechanical latching device to prevent system from resetting in case of loss of power to the release solenoid. Systems provided with solenoid only, without this mechanical latching device, shall not be accepted. Every valve shall be clearly identified as to its operation with arrows indicating all positions to facilitate system operation.

.2 Pressure gauges to indicate water supply, priming water and air pressures of the system. Each pressure gauge must be provided with its own three-way valve

.3 Release trim with solenoid valve, pneumatic actuator and every supervisory and alarm device required shall be Schedule 40 black steel.

.4 Steel pipe header painted fire red, with grooved ends to be connected to supply water from either side

.5 Schedule 40 steel pipe drain manifold of 2" diameter painted fire red, with grooved ends for drain connections from either side.

.6 Trim shall include properly identified contractor test ports factory mounted into the trim piping to facilitate system testing and commissioning.

.7 Integrated control panel with emergency batteries factory-assembled inside the cabinet

.8 The system shall have an Integrated Releasing Circuit Disconnect Switch to allow the system to be tested without actuating the fire suppression system as required per NFPA 72, 2010 Edition. Operation of the Disconnect Switch shall cause a supervisory signal at the releasing service fire alarm control unit. The disconnect switch shall be a physical switch and not be accomplished by using software.

.9 Field wiring terminal strips and junction box integrated with the cabinet for connection of field wiring.

.10 The cabinet assembly shall be pre-assembled, pre-wired and factory tested under ISO-9001 conditions

.11 The system shall incorporate all components required for complete system operation.

.12 Standard of acceptance:

.1 Fireflex – TotalPac3

.2 Victaulic

3.6 PRE-ACTION SYSTEM CONTROL PANEL

.1 Construction:

.1 modular enclosure with hinged door.

.2 operating on 120 volt AC supply;.

.3 24 volts DC output for operation of solenoid valve and alarm horn,

.4 White "Power On" light,

.5 Yellow and red pilot lights to indicate alarm and trouble conditions as follows:

.1 loss of supervisory air pressure in sprinkler piping (trouble).

.2 Control valve closed (trouble).

.3 Breaks or wiring fault in detector circuit (trouble).

.4 Detector operation (trouble).

.5 Solenoid supervision (trouble).

.6 Solenoid operated - water in system (alarm)

.6 DPDT form "C" contacts in control panel for Electrical Division 26 to connect remote annunciators and monitoring systems for trouble and alarm points described above.

.7 24 volt DC horn located near control panel sounding audible signals in alarm or trouble conditions.

.8 Switches inside front cover of panel for horn silencing and system reset.

.9 Battery back-up for power supply with battery charger module.

.10 Indexed screw-type terminal strip for connections under Electrical Division 26.

.11 Standard of Acceptance

.1 Potter

.2 Viking

.3 Tyco/Simplex/JCI

.4 Mircom

3.7 MULTIPURPOSE DRY CHEMICAL EXTINGUISHERS

.1 Stored pressure rechargeable type with hose and shut-off nozzle, ULC labeled for A, B and C class protection, or FE-500, as indicated red enamel finish. Size 9 kg (20 lb). Standard of Acceptance

.1 National Fire Equipment Limited - ABC

.2 Flag Fire Equipment Limited – ABC

.3 Johnson Controls – F-500

.4 Hazard Control Technologies – F500

.2 Extinguisher brackets: Supplied by extinguisher manufacturer.

.3 Identification of extinguishers: Include bilingual tag or label attached to extinguishers, in accordance with recommendations of NFPA 10, indicating month and year of installation, with space for service dates.

3.8 SIGNS

.1 Bilingual Signs for Control Drain and Test Valves: To ANSI/NFPA 13.

PART 3 EXECUTION

3.1 SPRINKLER INSTALLATION

.1 Supply and install all required automatic sprinklers. The sprinklers shall be glass bulb type, ULC listed and FM approved.

.2 Install system piping and fittings as per requirements of NFPA 13. Refer to Contract Drawings for more information.

.3 Provide headers, alarm valve assemblies and, valves.

.4 Valves to be fitted with supervisory switches as shown. Wiring from supervised valves and provision of supervisory annunciator will be done under Electrical Division 26.

.5 Provide signs at each valve identifying portion of system controlled. Fasten signs to pipe in immediate vicinity of valve.

.6 Wiring of trouble and flow alarms will be done under Electrical Division 26.

.7 Provide double-valved auxiliary drains at trapped low points in piping system. Insulate and electrically heat trace the auxiliary drain between the outlet valve and 50mm (2 in) above the inlet valve.

.1 Power will be provided by this Division; extend power wiring from the nearest Mechanical Power Panel and terminate in a junction box in the area served by the dry-pipe system. Extend 120 VAC wiring from this junction box to each auxiliary drain.

.2 Insulation and heat tracing are not required where auxiliary drains are located in heated areas.

.8 Locate sprinklers to suit available ceiling space and to avoid speakers, fire alarm components, lighting fixtures, ductwork, and diffusers. In general, centre over walkway spaces.

.9 Provide additional sprinkler heads with associated piping for sprinkler protection under ducts, under obstructions, and in blind spaces. Identify additional sprinkler heads on shop drawings with capital letter "A" and resubmit drawings to permit Inclusion of these sprinkler heads in hydraulic calculations.

.10 The proper operation and coordination of the systems' installation, including the automatic sprinkler system, detection system, signaling system and initial start-up are all under the responsibility of the fire protection contractor.

.11 Water supply for the cabinet shall allow a grooved connection to supply manifold from the left-hand side of the unit.

3.2 INSTALLATION OF PRE-ACTION SYSTEM DETECTORS

.1 Provision of detection system and connection to pre-action system control panel shall be done under this Section.

.2 Supply and install a complete electrical detection system including conduit, wiring, smoke detectors, manual pull stations, and connections to auxiliary functions.

.3 120 volt AC supply will be provided to pre-action system control panel under Division 26.

3.3 INSTALLATION OF FIRE EXTINGUISHERS

.1 Install extinguishers at project completion. Confirm location with local building or fire department prior to installation.

3.4 TESTING AND APPROVALS

.1 Test sprinkler system hydrostatically in accordance with requirements of NFPA 13.

.2 A drain test using the auxiliary drain valve fully open (drain located on water supply side, deluge valve inlet) must be performed to make sure that no back pressure in drain piping exists, which could affect the proper operation of the pre-action system.

.3 An air supply test must be performed, to confirm that normal air pressure can be restored within 30 minutes.

.4 Schedule testing to give at least two weeks' notice to following authorities

.1 Local Fire Department.

.2 Insurer's Representative.

.3 Owner.

.4 Consultant.

.5 Prior to testing, ensure that flow switches, pressure switches, supervisory switches and other devices are functioning.

.6 Obtain Contractor's Material and Test Certificate for above ground piping.

.7 Copies of Certificates to be distributed as per shop drawing requirements.

.8 On completion of project obtain Certificate of Approval showing that work has been carried out in accordance with the requirements of NFPA 13: “Standard for the Installation of Sprinklers Systems”

END OF SECTION

PART 1 GENERAL

1.1 SCOPE

.1 Provide packaged, factory-built computer room air conditioning units and associated condensers.

1.2 SHOP DRAWINGS

.2 Submit shop drawings for each unit with

.1 model number,

.2 performance and design data,

.3 outline dimensions,

.4 power requirements,

.5 inlet and outlet piping connection details,

.6 operating weights,

.7 loading points and loads.

.3 Include rating and power input requirements of unit fan, and cooling coil circuiting, rows, and fin spacing, and condenser design data.

.4 Provide diagrams showing piping for field assembly, with refrigerant flows, connection pipe sizes, and pressure drops.

.5 Provide schematic circuit diagrams showing electrical wiring, interlocks, starters, and relays with wire numbers and terminal numbers clearly identified.

1.3 WARRANTY

.1 Compressors to be warranted against burn-out five (5) years and warranty to include for labour and materials used in replacing compressors, and in cleaning, dehydrating, and charging refrigeration system.

PART 2 PRODUCTS

2.1 GENERAL

.1 Factory assembled, pre-piped and pre-wired packaged computer room air conditioning units, with floor stand, arranged for downflow, bottom discharge air delivery.

.2 Type: DX air cooled. Standard of Acceptance: Vertiv

2.2 CABINET

.1 Fabricated with welded steel frame and decorative panels.

.2 12.7 to 254 mm (0.5 to 1.0 in) thickness insulation on exterior panels,

.3 Panels:

.1 removable for access to control section and automatic control valve for servicing while fan and unit are in operation,

.2 secured with concealed fasteners or captive, quarter-turn fasteners

2.3 RETURN AIR PLENUM AND FILTER HOUSING

.3 Construction:

.1 fabricated from corrosion protected welded steel of unit construction with

.2 20 mm (¾ in) thick acoustic construction,

.3 filters: accessible through removable panels

2.4 FANS

.1 Integral direct-driven fan with backward-curved blades and electronically commutated DC motor

.1 dynamically and statically balanced,

.2 Provided with dedicated motor, fault monitoring circuitry, and speed controller

2.5 FILTERS

.1 50 mm (2 in) thick throwaway type, rating: MERV 8 to ASHRAE 52.2-2007

2.6 CONTROL SYSTEM

.1 Microprocessor based, with

.1 Start/stop button,

.2 manual reset circuit breakers,

.3 temperature and humidity control with sensitivity adjustment

.2 Display panel: unit mounted with read out indication of

.1 room temperature

.2 room humidity

.3 temperature setpoint 18° - 29°C (65° -85°F)

.4 temperature sensitivity

.5 humidity setpoint 40 - 60% RH

.6 humidity sensitivity.

.7 indication lights: panel mounted coloured LED's for:
- .1 heating
- .2 cooling
- .3 humidification
- .4 dehumidification
- .5 power on

.8 panel mounted coloured LED's and audible alarm to indicate malfunctions
- .1 High Temperature
- .2 Low Temperature
- .3 High Humidity
- .4 Low Humidity
- .5 Change Filters, with heavy duty, bellows type filter change pressure switch adjustable 0 Pa to 390 Pa (0 in wg to 2 in wg)
- .6 Loss of Air Supply

.7 Water Under Floor, with two water detectors per unit with 9.2 m (30 ft) of water tape, field connected

.8 High Head Pressure

.9 One push-to-test button to indicate functioning of all indicators and audible alarm

.3 Interface:

.1 One non-powered normally open contact to indicate alarm condition for connection to remote alarm system.

.2 One normally open, non-powered contact to close when unit is started.

.3 Building Automation System: microprocessor based communications card to communicate over BACnet protocol.

2.7 REFRIGERATION CIRCUIT

.1 Direct driven reciprocating or scroll semi-hermetic compressors operating at 1750 rpm with:

.1 thermal overloads,

.2 oil sight glass,

.3 manual reset high pressure switch,

.4 pump down low-pressure switch,

.5 suction line strainer,

.6 reversible oil pumps for forced feed lubrication, mounted on pad type vibration isolators, in separate compartment isolated from air stream.

.7 Electronic expansion valve

.2 Piping, valves, fittings, and related parts to CSA B52 with:

.1 thermal expansion valve,

.2 suction and discharge regulators,

.3 combination filter/dryer with replaceable core,

.4 solenoid stop valves,

.5 liquid sight glass with moisture indicator,

.6 high side pressure relief device and charging valve.

.3 Insulation: 19 mm (¾ in) of flexible elastomeric insulation on suction line.

.4 Condenser - air cooled, with one (1) fan with the following features:

.1 direct drive, slow speed, multiple propeller fan air cooled condenser,

.2 Variable speed, ball bearing, permanently lubricated, fan motor operating between 10 and 1050 rpm with internal overload protection,

.3 fitted with electronic head pressure control through variation of fan speed, for operation down to outside temperature of-29°C (-20°F)

.4 coil:

.1 aluminum fin, copper tube condenser coil,

.2 separate refrigeration circuit for each compressor,

.3 sized for outdoor air entering temperature of 38°C (100°F).

2.8 REFRIGERANT PIPING

.1 Code Compliance

.1 Installing contractor shall be TSSA certified and shall register the project with TSSA for all systems 5 tons and above.

.2 Installing contractor shall provide TSSA Certificate of Authorization as part of closing documents.

.3 Installation shall conform with CSA B52 and ASME B31.5 Mechanical Refrigeration Code.

.4 Welding materials and procedures shall conform to ASME SEC 9 and applicable provincial labour regulations.

.5 Safety pressure relief valves shall be field supplied and installed in the piping as per TSSA and Section 7 of CSA B52.

.6 Pressure relief valves shall be 600 PSI rated and installed in pairs (two valve per refrigeration circuit), and shall be supplied and installed for both the liquid and suction line as per drawing details. Pressure relief valves shall be individually isolated to allow for maintenance and required replacement.

.2 All systems shall display appropriate Ozone Depletion Prevention (ODP) tags prior to commissioning. VRF manufacturer shall not commission any system not displaying proper ODP tag.

.3 Materials

.1 All copper piping shall be air conditioning and refrigerant grade ASTM B280 ACR.

.2 Copper piping shall be type K copper.

.3 Brazing rods for all joints shall be 15% silfoss (5% silfoss shall not be acceptable as per TSSA).

.4 Quality Assurance

.1 Nitrogen purging shall be used on all brazed joints to minimize oxidization.

.2 Contractor shall provide manufacturer with all actual pipe lengths installed for calculation of refrigerant charge. Refrigerant piping contractor shall supply and charge system with required quantity of R-410a prior to manufacturer commissioning. Refrigerant charging shall be done in the liquid state.

.3 High/low pressure gas line, liquid and suction lines shall be individually insulated.

.1 All indoor refrigerant lines shall be insulated with minimum 1” wall diameter Armaflex.

.2 All outdoor refrigerant lines shall be insulated with minimum 1” wall diameter Armaflex and suitable for outdoor service. Exposed insulation shall be protected by aluminum, sheet metal, with an approved UV coating that is water resistant and provides shielding from solar radiation.

.3 Pipe clamps shall fasten around the piping insulation. Pipe clamps that compress the copper directly shall be installed a minimum of 36” away from joints, and shall be loosely tightened to allow for copper expansion.

.4 Pipe supports shall be a maximum of 6’ apart.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Mount units on floor.

.2 Power wiring to the line side of factory installed, and internally wired disconnect switch, will be provided under Electrical Division 26.

.3 Install piping to outdoor heat rejection equipment and as noted and indicated on M-02

.4 Install water detectors as indicated on plans and connect to unit controller

3.2 REFRIGERATION PIPING

.1 Swab each length of refrigeration piping with cloth soaked in refrigerant oil and remove dirt, filings, and visible moisture.

.2 Keep piping ends sealed except when fabricating joints.

.3 Grade horizontal pipe carrying gases 1:240 down in direction of flow.

.4 Tubing installed in trenches or conduit under floor to be level.

.5 Support lines at intervals of not more than 8 ft (2.4 m) and anchor within 3 ft (1 m) of each elbow. Keep elbows and fittings to minimum.

.6 When multiple runs are installed, spread pipes to 6 in (150 mm) minimum to allow for expansion and contraction.

.7 Use rubber grommets between tubing and clamps to prevent line chafing.

.8 Bleed dry nitrogen into piping when sweating connections.

3.3 PRESSURE AND LEAK TESTING

.1 Perform leak test before evacuating system.

.2 Comply with CSA B52 with gauge pressure of 300 psi (2 Mpa) on high side and 150 psi (1 Mpa) on low side.

.3 Use refrigerant gas as tracer with dry nitrogen to develop pressure.

.4 Prime oil separator and oil level control system with operating charge of compressor oil.

.5 Compressors with refrigerant holding charge to remain isolated from system.

.6 Build to 5 psi (35 kPa) initial refrigerant pressure in high and low side and add dry nitrogen to field test pressure.

.7 Test for leaks with halide detector.

.8 Where leaks are found, isolate defective area, discharge gas, repair leaks, and retest.

3.4 DEHYDRATION

.1 Evacuate using two stage vacuum pump with gas ballast on second stage capable of pulling vacuum of 50 microns (0.05 mm hg).

.2 Fill pump with fresh dehydrated oil before starting work.

.3 Connect high vacuum hose or seamless copper tubing jumper lines to both high and low pressure sides.

.4 Install thermocouple vacuum gauge with micron (mm) scale to measure system pressure.

.5 Locate manual isolating valve between pump and vacuum gauge and take readings with system isolated from pump.

.6 When compressor/condensing unit has refrigerant holding charge intact, service valves to remain closed during evacuation.

.7 Evacuate equipment received with dry air, wrong refrigerant, or lost holding charge and if compressor is being evacuated energize crankcase heaters during process.

.8 Triple evacuate system as follows

.1 Evacuate to 1500 microns (1.5 mm) and hold for 4 hours.

.2 Break vacuum to gauge pressure of 2 psi (14 kPa) with refrigerant, charging through filter-drier.

.3 Evacuate again to 1500 microns (1.5 mm) and hold for 2 hours.

.4 Break vacuum with refrigerant as before.

.5 Evacuate for third time and continue pumping for minimum 1 hour after reaching 500 microns (0.5 mm).

3.5 CHARGING

.1 After evacuation is complete, break vacuum with initial charge through high side charging valve with pressure gauge and new filter-drier installed in connection to charging valve.

.2 Calculate amount of refrigerant required and meter refrigerant into system. When calculated amount has been charged, close liquid charging valve, start system and monitor sight glass at receiver outlet.

.3 When refrigerant container is to be changed during charging process, re-purge charging line after connection of new container.

.4 Low side charging to be permitted only for charging small amounts of refrigerant in gaseous state.

3.6 SYSTEM START-UP, CHECK-OUT AND ADJUSTMENT

.1 Provide instruments, gauges, and testing equipment.

.2 Check compressor oil level and add oil to bring level to center of crankcase sight glass. Use only refrigeration oil recommended by compressor manufacturer, from factory sealed, unopened containers.

.3 Adjust controls to obtain design conditions and verify equipment performs in accordance with manufacturer's ratings.

.4 Test and record refrigerant temperatures and pressures cooling apparatus entering and leaving air temperatures, outdoor dry bulb and wet bulb, room dry bulb and wet bulb and condenser water temperatures and flow quantities.

.5 Test and record voltage and running amperes on each phase of each motor and compare to nameplate data. Also record starter heater rating for each motor.

.6 Ensure that insulation of refrigerant piping and accessories is completed.

3.7 MANUFACTURER’S COMMISSIONING AND STARTUP

.1 Provide factory-trained and authorized startup technician for the purposes of verifying installation and performing equipment energization and startup according to manufacturer’s

written instructions and guidelines, following manufacturer's startup and commissioning checklist.

.2 Submit completed startup and commissioning documentation, signed and dated by the startup technician. All fields shall be completed, and items marked not applicable shall include specific comment or note to explain the reason the item determined to be not applicable. All tests required by the manufacturer as part of the startup and commissioning process shall be documented and submitted alongside the completed startup and commissioning documentation.

END OF SECTION

PART 1 GENERAL

1.1 SCOPE

.1 Provide UL listed Equipment Monitoring Panel, including Equipment Monitoring Controller, Network Switch, and electrical power supply as specified herein.

.2 Provide Equipment Monitoring Controller (Monitoring Controller) for integrated control, supervision, data logging, alarming, and network management to monitor electrical and mechanical equipment via network and hardwire communications.

.3 Provide unmanaged Network Switch to facilitate equipment monitoring and control via local area network.

.4 Provide controller software, graphics, and programming.

.5 Provide integration of new systems to owner's existing network according to owner's network and security standards, including coordination with owner's network and security team.

1.2 APPLICABLE STANDARDS

.1 ANSI/ASHRAE standard 135 BACnet

.2 Interfacing Standard: IEEE 802.3 Ethernet 10Base-T LAN.

1.3 ABBREVIATIONS AND DEFINITIONS

.1 The following definitions, abbreviations, and acronyms apply:

.1 AI: Analog Input: continuously variable value, usually a sensor, referenced to a controller

.2 AO: Analog Output: continuously variable value, usually a control signal to an actuator device, referenced to a controller.

.3 BI: Binary (digital) Input: a two-state (On-Off) value, usually .4

.4 BO: Binary (digital) Output: a two-state (On-Off) value, usually associated with starting or stopping equipment or generating an alarm, referenced to a controller.

.5 GUI: Graphic User Interface : an LED, LCD or monitor display

.6 I/O: Input/Output

.7 LAN: Local Area Network

.8 NC: Normally Closed: position of device in a de-energized state.

.9 NO: Normally Open: position of device in a de-energized state.

1.4 LICENCES AND OWNERSHIP

.2 Ownership of, and licences for, hardware and software supplied or used for this project or for ongoing system operation, maintenance and modification to be registered, without restrictions, in Owner's name.

.3 This is applicable to System Software, Workstation Application Editors, and Controller Software.

.4 Licensing to permit one user to access system without additional fees.

.5 As of last day of warranty period, software is to be upgraded to current version or release.

.6 Project developed software and resulting documentation to be treated as part of system and subject to these same requirements for ownership and licensing. This material includes:

.1 Project graphic images

.2 CAD generated record drawings

.3 Project database

.4 Project specific application programming code and documentation.

1.5 SHOP DRAWINGS

.1 Submit one completely engineered and coordinated shop drawing package. Partial or incomplete submission of data and/or drawings will be returned without review.

.2 Submit shop drawings for designed elements:

.1 list of materials of equipment to be used indicating manufacturer, model number, and other relevant technical data.

.2 BAS riser diagram showing system controllers, network swtiches, and network wiring, and connection to external networks

.3 single-line schematics and system flow diagrams showing location of control devices.

.4 points list for equipment monitoring controller, including: Point Type, System Name, Object Name, Expanded ID, Display Units, Controller Type, Address, Cable Destination, Panel, Reference Drawing, and Cable Number.

.5 points to be named by function, and list to include software points such as programmable set-points, range limits, time delays, and so forth

.6 Sequence of Operations to cover normal operation and operation under various alarm conditions applicable to that system, as described on drawing M-04

.3 Submit catalogue cut-sheets for;

.1 manufacturer's description and technical data, such as performance curves, product specification sheets, and installation/maintenance instructions for equipment and hardware items as follows;

.2 Equipment Monitoring Controller

.3 Network switches

.4 Transducers/Transmitters and Sensors with accuracy data, range and scale information,

.5 Relays/Switches

.6 Panels

.7 Power Supplies

.8 Batteries

.9 Operator Interface

.10 Wiring and wiring accessories

.4 hardware data sheets for Operator Interfaces:

.1 Submit supporting documentation:

.2 examples of graphics for Operator Interface:

.1 Server room floor plan graphic

.2 typical graphics, at least one sample graphic for each type of equipment,

.3 description of techniques used for animation of information displayed on graphics

.5 Software manuals for applications programs for Operator Interface, portable operator terminals, and programming devices.

.6 Protocol Implementation Conformance (PIC) statement for BACnet devices.

.7 Where interfaces occur with control or wiring diagrams of other sections, obtain reproducible copies of these diagrams and revise to show terminal numbers at interface and include diagrams as part of interconnection schematic shop drawings.

PART 2 PRODUCTS

2.1 GENERAL

.1 Provide Equipment Monitoring Panel which functions and meets detailed performance criteria when operating in following minimum ambient condition ranges:

.1 Temperature – 0°C to 32.2°C (32° to 90°F),

.2 Relative Humidity 10% to 90% non condensing,

.3 Single-point electrical power service of single phase, 120 VAC +/- 10%, 60 Hz nominal,

.4 Operating voltage: operate at 90% to 110% of nominal voltage rating and to perform an orderly shutdown below 80% nominal voltage,

.5 Operation to be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

.2 Equipment Monitoring Panel shall be designed and manufactured by a control panel manufacturer registered with Underwriters' Laboraties (UL) Industrial Control Panel Shop Program to meet UL 508A

.3 Provide control transformers for system components requiring power supply that do not have integral control transformers.

.4 Power distribution within the panel shall be arranged to allow isolation of any one component

.5 If network switch is provided as plug-in type power cord, provide dedicated receptable within panel for network switch power

.6 All incoming and outgoing wiring shall be landed at designated and labeled terminal blocks

.7 All incoming, outgoing, and internal wiring shall be labelled at each termination within the panel, including:

.1 Power – Termination location, Voltage/Phase/Hertz, and upstream disconnecting device.

.2 Signal – Termination location, signal type AI/BI/AO/BO, and point name according to points list

.3 Communications – Cable type, communications protocol, and both connecting devices

.8 This installation is not to be used as test site for newly developed product or software, without explicit written approval.

2.2 EQUIPMENT MONITORING CONTROLLER

.1 General:

.1 stand alone, multi-tasking, multi user, real time digital processors with hardware, software, and communications interfaces, power supplies, and input/output modular devices.

.2 removable (hot swapable) without disconnection of terminals and wiring,

.3 primary and secondary network communication ports

.4 support firmware upgrades without need to replace hardware and to have spare capacity for I/O.

.5 continuously perform self-diagnostics, communication diagnosis, and provide both local and remote annunciation of any detected component failures, low battery condition; and upon failure to assume predetermined failure mode.

.2 Input/Output points:

.1 hardwired inputs and outputs according to points list on drawings

.2 protected such that shorting of point to itself, shorting of point to another point, or shorting of point to ground will not damage controller.

.3 protected such that voltage spikes of up to 24 V, of any duration, and any polarity will not damage controller.

.4 Analog input: compatible with, and field configurable to commonly available sensing devices using low voltage signals (0 10 VDC), current signals (4 20 ma), or resistance signals from thermistors or RTD.

.5 Analog output: in form of modulating electronic signal, either voltage mode (0 -10VDC) or current mode (4 -20mA).

.6 Binary inputs: allow monitoring of on/off signals from remote devices. Binary inputs to provide wetting current of at least 12 ma and to be compatible with commonly available control devices.

.7 Binary outputs: provide on/off operation, or pulsed low voltage signal for pulse width modulation control. Binary outputs to be relays, 24 Volts AC or DC maximum, having 3 Amp maximum current. Each relay to be configured as normally open or normally closed, and either dry contact or bussed.

.8 Universal inputs: Thermistor Precon Type II, dry contacts, or 0 -5VDC with 0 -10K Ohm input impedance.

.3 Spare I/O capacity: Minimum two spare I/O of each type

.4 Time Clock: on-board real-time clock.

.5 Communications:

.1 Dual RJ-45 communication ports for connection to owner's network (primary port) and local equipment network switch (secondary).

.2 communications services over primary network to support remote monitoring via Operator's Interface (OI):

.1 OI to operate through standard desk top or lap top personal computers without requiring purchase of special software from BAS manufacturer.

.2 Interface on these personal computers to be standard Web Browser by Microsoft or Firefox.

.3 Software to be completely web based without need for interface/translation devices or need to load software individually on each computer.

.4 System and software to permit remote access, for multiple users, through internet connections.

.5 Graphic files to be created with use of graphics generation package furnished with system.

.6 Software to support concurrent operation of multiple standard and non-standard protocols including but not limited to:

.1 BACnet
.2 MODBUS
.3 LONTalk
.4 OPC
.5 SNMP

.3 communication services over secondary network to support operator interface performance, and value passing as follows:

.1 connection of an operator interface device to the unmanaged network switch to allow operator to interface with controller as if that interface were directly connected to the controller

.2 data, status information, control algorithms, inputs, outputs, etc., from controller is to be available for viewing and editing through operator interface device that is connected to controller via unmanaged network switch.

.6 GUI:

.1 face mounted LED type annunciation to display operational mode, and power and communication status.

.2 Monitoring controller shall include on-board graphics with remote-access capabilities of floor-plan based system graphics:

.1 Graphics generation package to be graphically based system that uses mouse to add dynamic data and system control symbols to background graphic saved in an industry standard format such as BMP, JPEG, or GIF.

.2 Web based systems to be viewable on browsers compatible with World Wide Web Consortium browser standards.

.3 Web graphics to be either HTML or JavaScript and require no plug ins or use plug ins that are widely available to end users

.4 Primary BAS graphic shall utilize floor plan drawings of Server Room, showing each piece of equipment, and each sensor or device monitored by the Equipment Monitoring controller via on-board equipment controllers but located outside of the equipment footprint.

.5 Animated or active alarm and status flags to be provided for each point as noted on control schematics and Sequences of Operation. Areas or equipment where an alarm condition exists to be highlighted by means of colour or other visual indicator.

.6 Individual Graphics to be provided for each equipment based on equipment schematics (mechanical equipment) or internal electrical single-lines from the manufacturer (electrical equipment)

.7 Floor plan graphics showing mechanical and electrical equipment, temperature and humidity sensors, and leak detectors to use electronic CAD/Revit files, updated to reflect as-built conditions as shown on record drawings, and to provide animated

run and alarm status for equipment, control systems, temperature and humidity sensors, and leak detectors. Use multi-value colour coding to represent equipment/sensor status as “normal” (green), “outside of acceptable range” (orange), “active alarm” (red) and “communication error” (yellow). Incorporate graphic pointing technique to permit navigation to each individual control system shown on floor plan graphic, and where live values of points are shown, links shall direct to trend graphs

.8 Screens to be provided for:
- .1 Room floor plan,
- .2 Individual equipment pages
- .3 Alarm console
- .4 Equipment monitoring controller self-reported status/diagnostic information

.7 Power interruption:

- .1 In event of normal power loss
  - .1 provide orderly shutdown of controllers to prevent loss of database or software programming,
  - .2 incorporate nonvolatile memory for critical configuration data,
  - .3 battery backup to be provided to support real time clock and volatile memory for minimum of 72 hours.

.8 Memory: sufficient memory to support operating system, program, and database requirements including:

- .1 device and network management.
- .2 data sharing.
- .3 alarm and event management including custom alarm messages for each alarm level for each point noted in I/O Schedule.
- .4 energy management.
- .5 collection of historical trend data for operator selected points.
- .6 maintenance support.
- .7 scheduling.
- .8 dial up communications.
- .9 manual override monitoring.

2.3 CONTROLLER SOFTWARE

.1 General

- .1 Applications software for building systems operation and monitoring and energy management to reside and operate in Equipment Monitoring Controller
- .2 Using of applications to be available to an operator with appropriate authorization, through operator web browser interface via remote access/VPN
- .3 Software to support concurrent operation of multiple standard and non-standard protocols including but not limited to:
  - .1 BACnet
  - .2 LonTalk
  - .3 SNMP

.2 Software application programs:

.1 Alarms

.1 each binary input and binary value object capable of generating an alarm based on an operator specified state and to have capability to enable or disable this alarm.

.2 each analog object capable of generating an alarm based on an operator specified high and low alarm limit and to have capability to enable or disable this alarm.

.3 delivered with alarms enabled as listed in Sequences of Operation.

.2 Run Time Totalization.

.1 calculation routine that totalizes run times for any binary input or object with operator selected high runtime alarms.

.2 delivered with run time totalization and alarms configured as specified in Sequences of Operation.

.3 Trending/Historian data base

.1 The value of each point as indicated as “trend” in points list on M-04 shall be logged at an interval of 30 minutes (analog inputs/outputs/values) or on change of value (binary inputs/outputs/values or multi-state values) to a database stored on the equipment monitoring controller

.2 The equipment monitoring controller shall provide a means to navigate, export to .csv file, and display graphically over custom time and value ranges, all point histories stored to the controller database.

2.4 NETWORK SWITCH

.1 Provide DIN rail-mounted unmanaged network switch capable of 10/100/1000-Mbps speeds

.2 Provide switch with minimum 10, maximum 12 ports. Where switch number of ports exceeds 12, higher port counts may be provided upon application to consultant where application includes demonstration that network switch form factor fits within a wall-mounted panel including all other components required for Equipment Monitoring Panel, and wall-mounted panel fits in location indicated on drawings without conflicting with electrical or mechanical equipment clearances.

.3 Switch shall include loop detection features to avoid “broadcast storms”

.4 Network switch shall meet, at minimum, the following standards:

.1 IEEE 802.3 10BASE-T Ethernet

.2 IEEE 802.3u 100BASE-TX Fast Ethernet

.3 IEEE 802.3ab 1000BASE-T Gigabit Ethernet

.4 IEEE 802.3z Gigabit Ethernet

.5 IEEE 802.3x Flow Control

.5 LED indicators as follows:

.1 System/PWR link/activity

.2 Cable diagnostics

.3 Loop detection

.6 Physical interfaces

.1 10/100/1000 Ethernet

.2 Support for 802.3af Power-over-Ethernet (PoE)

.3 Power port for AC adapter for power cord

PART 3 EXECUTION

2.5 COORDINATION

.1 Coordinate and schedule control work with other work in same area to ensure orderly progress.

.2 Controls work by others:

.1 Integrate and coordinate this control work with controls and control devices provided or installed by the CRAC unit manufacturer/supplier

.2 Each supplier of control product to configure, program, start up, and test that product to satisfy requirements of Sequence of Operation regardless of where within contract documents product is specified or described.

.3 Work with the CRAC unit manufacturer to resolve compatibility issues between control products provided under this section and those provided under Div 23

2.6 EQUIPMENT MOUNTING

.1 Install equipment in accordance with manufacturer's recommendations, or

.2 In the absence of manufacturer’s recommendations, mount units on modular channel frames (Unistrut or equivalent) in the location as indicated on drawing M-02, with modular channel frames secured to the framing of the building walls.

2.7 CONFIGURATION

.1 Configure Web access according to three levels:

.1 Administrator, full capabilities to edit, access, override, export and manage features of the system

.2 Operator, providing full capabilities to acknowledge alarms, access point values, trend and alarm logs, and export the same

.2 Configure network switch and network to accommodate unit-to-unit communication of computer room cooling units, including coordination with the CRAC unit manufacturer’s authorized startup technician for the assigning, configuration, programming and management of IP addresses.

2.8 WIRING AND LABELLING

.1 Electrical materials, equipment, and installation procedures under to conform to Ontario Electrical Safety Code as amended to date and standards established in Division 26.

.2 Provide all control wiring within dedicated conduit, painted blue or marked with blue colour bands every 25’, on either side of every penetration, and within 5’ of every change of direction:

.1 thin wall (EMT) conduit up to and including 32mm (1/1/4 in) size for exposed wiring up to 3 m (10 ft) above floor level,

.2 watertight compression fittings in exterior locations.

.3 Where conduit leaves heated areas and enters unheated areas, seal conduit.

.4 Label wiring and cabling, including that within factory-fabricated panels, with control system address or termination number at each end within 50 mm (2 in) of termination.

.5 Label each control component with permanent label. Label plug-in components so that label remains stationary during component replacement.

.6 Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.

2.9 COMMISSIONING, START-UP SUPPORT AND TRAINING

.1 Provide the services of a qualified technician to assist the CRAC unit, UPS and ATS manufacturers in the startup, configuration, integration, networking, troubleshooting and verification of equipment to meet the points lists and sequence of operations on drawing M-04.

.2 Provide a qualified technician to demonstrate to the owner and owner's employees the proper function, interaction with and maintenance of the provided equipment monitoring controller and associated web interfaces.

END OF SECTION

ELECTRICAL SPECIFICATIONS

PART 1 - GENERAL

1.1 SCOPE

1. The work described in this specification covers the supply and installation of electrical equipment and materials, testing and commissioning of the systems installed, and other services as described in the various sections of the electrical specifications and as shown on the drawings.

2. The scope of the electrical work includes, without being limited to the following:

   1. Disconnection and removal of the following existing equipment and services:

      On Level P1, Sprinkler Pump Room:

      .1 1-800A and 2-400A disconnect switches
      .2 1-800A splitter

      On 3rd Floor Former AV Lab:

      .1 2-120/208 V panelboards
      .2 1- Rogers panel
      .3 all feeders, branch circuits and associated raceways
      .4 all lighting fixtures and wiring devices

   2. One 600 V, 1200 A, 3-wire switchboard, to be located in the Main Electrical Room on Level P1

   3. Two 40 kVA, 600 V in, 120/208 V out UPS modules and batteries

   4. Two 600 V, 200 A power distribution panels

   5. One automatic transfer switch, 600 V, 60A, 3P

   6. One 15 kVA dry-type transformer and one 100A, 120/208 V, 4-wire distribution panelboard

   7. Lighting fixtures

   8. Wiring devices (lighting controls, receptacles, fire detection and security devices)

   9. Supply and installation of cables, wiring and raceways to the new equipment installed, including:

      .1 single and/or multi-conductor power and control cables
      .2 communications cables for monitoring
      .3 conduits, junction and pull boxes, cable trays, and associated support systems

   10. Modifications to selected existing feeders, connections, and equipment to achieve the desired configurations,

   11. Testing and commissioning of all equipment and systems supplied and installed, according to the requirements specified in Division 01

   12. Work on ‘premium time’ (i.e. during some night and/or weekends) as directed by the Owner and required by the occupancy of the area affected by the work,

   13. Preparation of MOP documents (Method of Procedure) for the critical activities,

   14. Provision of fire alarm bypass and fire watch during critical activities, and

15. All other work required to deliver a complete and functional system, whether detailed on the drawings or described in the specifications.

1.2 DEFINITIONS

1. Wherever the words "equal", "approved", or "approved equal" are used, they shall be understood to mean, "equal", "approved", or "approved equal".
2. "Concealed" is defined as "out of sight" in "normal" viewing conditions, and includes buried in concrete, above acoustic tile or gypsum board ceilings, within masonry or gypsum board constructed walls, within cable trays, or below raised access floors.
3. Whenever the words "install", "provide", or "supply and install", are used, they shall be understood to mean "provide and install, inclusive of all labour, materials, installation, testing, and connections" for the item to which they refer.

1.3 CODES AND STANDARDS

1. All work shall meet or exceed the latest applicable Codes and Standards. Do complete installation in accordance with the Ontario Electrical Safety Code – 2021 and applicable Bulletins (the Code) except where specified otherwise.
2. Abbreviations for electrical terms: to CSA Z85.
3. Unless noted otherwise, reference to a code or standard shall mean the most recent version of that code or standard.

1.4 PERMITS, FEES, AND INSPECTION

1. The Contractor shall obtain all necessary permits, pay the fees, and make the work available for inspection as necessary to comply with the regulatory requirements of the authorities having jurisdiction.

1.5 DRAWINGS AND SPECIFICATIONS

1. Drawings and Specifications are intended to cover the scope of work described herein. It is not the intent to show or describe every detail, and it shall be agreed that the Contractor will provide all work and material required to satisfy the intent of the Drawings and Specifications.
2. Drawings and Specifications are not guaranteed to be free of discrepancies and the Owner and/or Consultant will not be responsible for the absence of any detail the Contractor may require, or for any special work, equipment, material, or labour which may be found necessary as the work progresses.
3. It shall be specifically understood that the omission of any Drawing, Detail or Schedule, or reference thereto, or any item from any Drawing, Detail or Schedule, or from the Specification, which is required to make the work complete and operational, shall not relieve the Contractor from the obligation of providing the required items and associated labour.
4. Any discrepancies shall be submitted to the Consultant for his instructions.

1.6 VOLTAGE RATINGS

1. Operating voltages to: CAN3-C235.

1.7 CONSULTANT'S INSTRUCTIONS

1. During construction, the Consultant will issue such instructions in writing as may be necessary for verification and correction of the work. These instructions shall be binding as part of the Contract Documents.

1.8 ADDITIONAL WORK AND CHANGES

1. No additional money over and above the Contract Price will be paid for extra work unless a written order, signed by the Owner's representatives for such work is given.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

1. Equipment and material shall be new and suitable for the use intended.
2. Equipment and material shall be certified by CSA or such other agency as may be recognized by the Electrical Safety Authority. Where there is no alternative to supplying certified equipment, obtain special approval from the Electrical Safety Authority, and notify the Consultant of any extra costs.
3. Factory-assemble control panels and component assemblies.
4. Where materials, equipment, apparatus, or other products are specified by a manufacturer's brand name, type or catalogue number, such designation is to establish the standards of desired quality, style, or dimensions, and shall be the basis of the Bid. Furnish materials so specified under this Contract unless changed by mutual agreement.
5. Where the use of equivalent, alternate or substitute equipment alters the design or space requirements indicated on the plans, the Contractor shall include all items of cost for the revised design and construction, including the cost of all the other trades involved.
6. Acceptance of the proposed equivalents, alternates or substitutions shall be subject to review by the Consultant and, if requested, the Contractor shall submit for inspection, samples of both the specified and the proposed alternate items.
7. In all cases where the use of equivalents, alternates or substitutions is permitted, the Contractor shall bear any extra costs incurred by the Consultant in evaluating the quality of materials and the equipment to be installed.

2.2 EQUIVALENTS AND ALTERNATES

1. Should the Contractor propose to furnish material and equipment other than those specified, he shall apply in writing to the Consultant for approval of equivalents at least five (5) working days prior to the closing of Tenders, submitting with his request for approvals, complete descriptive and technical data on the item or items he proposes to furnish.
2. Approval for changes in the base bid specifications will be considered only upon the individual requests of the Contractor. No blanket approval for equipment will be given to suppliers, distributors, or contractors.
3. Unless requests for changes in base bid specifications are received and approved prior to the opening of the bids, as defined above, the Contractor will be held to furnish all specified items under his base bid. After the contract is awarded, changes in specifications will be made only as defined in this Section.

4. Alternates may be offered in lieu of items named in the specifications. Alternate proposals must be accompanied by full descriptive and technical data on the article proposed, together with a statement of the amount of addition or deduction from the base bid if the alternate is accepted. Prior review by the Consultant is not required on items submitted as alternate bids, but the decision on acceptance of the alternate(s) will rest with the Consultant.

5. Replace unspecified materials and/or rejected equivalents and alternates built into the work with specified or accepted materials, at no additional cost to the Consultant.

6. In case of differences in price, the Owner shall receive all benefit of the difference in cost involved in any substitution, and the Contract shall be altered by change order to credit the Owner with any savings so obtained.

7. Materials and equipment substituted or offered as alternatives shall have spare parts and servicing available and shall fit into the space allocation shown on the drawings.

8. If any material or equipment being considered for substitution involves additional design, architectural, or engineering fees or other costs in checking whether or not the substitute material or equipment is suitable for the project, such fees or costs shall be paid for by the Contractor.

2.3 SHOP DRAWINGS

1. Submit shop drawings in accordance with relevant Section.

2. After execution of the Contract, within ten (10) working days, provide a schedule for shop drawing submission and a schedule for the delivery of equipment to the site. At this stage, identify any equipment whose delivery time could negatively impact the project completion date. Failure to do so will require the Contractor to provide temporary equipment until the specified equipment is available.

3. Specifications and Drawings are intended to cover all electrical systems. It is not the intent to describe or show every detail, and it shall be agreed that the Manufacturer will provide all work and material required to provide equipment according to the requirements and intent of the Drawings and Specifications.

4. Submitted Shop Drawings must indicate details of construction, dimensions, scale, capacities, weights and electrical performance characteristics of equipment or materials, as well as project name and specification reference Section number.

5. Shop drawings shall be provided in electronic format (pdf), with space on the front sheet for the Contractor's and Consultant's "Review" stamps.

6. Where applicable, include wiring, single line and schematic design drawings, and diagrams showing interconnections with other equipment, devices, and the work of other trades.

7. Work affected by submittals shall not proceed until review is complete.

8. Review submittals prior to submission to Consultant. This review represents that necessary requirements have been or will be determined and verified, and that each submittal has been checked and coordinated with requirements of the work and Contract Documents.

9. Changes made to Shop Drawings by the Consultant will not affect the Contract Price.

    1. Shop drawings will be reviewed by the Consultant and returned to the Manufacturer marked "REVIEWED", "REVIEWED AS NOTED" or "REVISE AND RESUBMIT". Shop drawings noted "REVISE AND RESUBMIT" shall be corrected and re-submitted.

2. No equipment shall be delivered to the job site unless the Manufacturer has received a "REVIEWED" or "REVIEWED AS NOTED" copy of the pertinent shop drawing.

3. The Manufacturer's Schedule shall allow five (5) business days for review or return for correction of shop drawings submitted to Consultant, with the time period starting at the time of receipt of the Drawings by the Consultant.

PART 3 - EXECUTION

3.1 SPECIAL CONDITIONS

1. The Contractor shall be aware that the work under this scope is subject to limitations imposed by the occupancy of the area in the immediate vicinity of the work. Limitations include:

   .1 Performance of work generating noise, dust, and disruption due to construction traffic through adjacent spaces. Corridors etc.

   .2 Activities that may affect power to the base building systems on normal or emergency power - to be generally identified by the Owner and the Consultant and specifically determined by the Contractor through its own investigation.

   .3 Some work that may have to be performed according to stringent Method of Procedure (MOP) documents. Contractor shall provide the Owner with a schedule of MOP documents for review and approval.

   .4 Work subject to MOPs generally includes activities that result in loss of power supply to some loads, operation on generator power, and/or disconnection of existing equipment for the purpose of reconnection to a new supply

2. The MOP document for such activities shall include:

   .1 Objective/purpose of the activity (Example: disconnection, tie-in, load transfer, installation, testing etc.)

   .2 Systems affected

   .3 Sequence of steps / tasks to be performed, with identification of location, equipment, and component on which the work will be done

   .4 Responsibility for performing the tasks (Contractor, equipment Vendor, building Operations etc.)

   .5 Estimated duration of the tasks, start and end times

   .6 Contingency / back-out plan for unforeseen situations

   .7 Safety precautions to be taken during the performance of specific tasks

   .8 Initial checks of systems' condition at beginning of MOP activity and post-completion checks to ensure restoration to normal of affected systems at end of activity.

3. The schedule of MOP activities shall list all MOP documents to be provided for the Work, and the activities to which they relate. The Contractor shall provide to the Owner all MOP documents for review and approval prior to proceeding with the Work. MOP documents shall be written for the specific electrical system(s) affected by the Work.

.1 Restriction of work to times and durations prescribed by the Owner. Unless otherwise approved by the Owner, all work affecting the operation of the existing systems including testing and commissioning must be performed during time windows prescribed by the Owner.

.2 Controlled access and security requirements.

.3 Any other operations that may become necessary for the completion of the work.

4. The required MOPs shall be prepared and submitted for review by the Owner at least 20 days in advance of the contemplated work.

3.2 INSTALLATION - GENERAL

1. Lay out of the work of this contract. Take special precautions and note drawing scales. Make field verifications of dimensions on plans since actual locations, distances, and elevations will be governed by actual field conditions.
2. Wherever differences occur between plans and riser diagrams or schematics, and between specifications and drawings, the most stringent conditions shall govern. Bring discrepancies between plans, or between plans and actual field conditions, or between plans and specifications promptly to the attention of the Consultant for clarification.
3. As the work progresses and before installing apparatus, equipment, fixtures, and devices which may interfere with the interior treatment and use of the building, obtain approval from the Consultant of detailed drawings or sketches for the exact location of all electrical raceways, panels, trays/ladders, equipment, fixtures and wiring devices. Failure to do so will make the Contractor responsible for rectification at his own cost.
4. Confer with other trades engaged in the work and arrange the work so that it will be carried out in the best interest of all concerned. Before commencing to work, check and verify with the Consultant all elevations, levels, dimensions etc. to ensure proper and correct installation of the work.
5. Protect finished and unfinished work and equipment and work of other trades from damage due to the carrying out of the work of this trade.
6. In addition to the work specifically mentioned in the specifications and shown on the drawings, provide all other items that are required by the authorities having jurisdiction over the work.
7. Contain all work being performed within the physical area of work which is underway during any particular period. Keep the amount of disruption in the existing building to a minimum.
8. Advise the Owner and Consultant in advance of any work that may interfere with or cause disruption to existing operations. Should the work within a particular area cause any electrical apparatus in another area to cease to function properly, identify and remedy the problem within the shortest possible time.

3.4 RESPONSIBILITY FOR SUPPLIED EQUIPMENT

1. All equipment and materials under this contract shall be supplied by the Contractor.
2. For all supplied equipment, the Contractor’s responsibilities include the following:
   1. Reviewing shop drawings and coordinating with the construction drawings.
   2. Coordinating equipment delivery with the supplier

3. Offloading and moving equipment to the installation location; inspection after offloading and reporting to Owner/Consultant of any defects or damage.
4. Installing equipment in their designated locations
5. Supplying and installing power feeders, control/signal wiring and communications cables, complete with necessary components as per manufacturer's recommendations.
6. Re-assembling factory made shipping splits as per Manufacturer's recommendations.
7. Testing and commissioning of equipment as per Manufacturer's recommendations.
8. Arrange for Manufacturer's competent technical representative to review and approve installation and participate in the testing and commissioning.

3.5 SCHEDULING OF WORK

1. For all work to be performed under this contract, adhere to construction schedule detailed in other parts of the contract.
2. Ensure that all equipment and material is ordered in time to meet the schedule. Provide a schedule of deliveries to the Consultant/Owner and include the following milestones: shop drawings submittal, factory test, and shipment.
3. Proceed with the work as quickly as practical so that construction may be completed in as short a time as possible and in accordance with the construction schedule.
4. Co-ordinate all required power transfers and shutdowns of existing services with the operating staff to maintain any disruption to a minimum. Provide ample notice to the Owner before proceeding with work on any existing service or equipment.

3.6 INSTALLATION OF RACEWAYS

1. Install all cable trays, conduits, etc. to conserve headroom and interfere as little as possible with the free use of the space through which they pass.
2. Install cable trays, conduits, wireways, etc. particularly those which may interfere with the inside treatment of the building, or conflicting with other services in place, only after the locations have been fully coordinated with the other services or trades.
3. Take special care in the installation of conduits, wireways, etc. which must be concealed to see that they are within the finished lines of floors, walls, and ceilings. Where such conduits, wireways, etc. have been installed in a manner causing interference, remove and reinstall in suitable locations without extra cost.
4. Do not remove or damage any structural fireproofing. Leave space to permit the fireproofing to be inspected and/or repaired.

3.7 CUTTING AND PATCHING

1. Employ the trade responsible for a particular item of work to do all cutting, patching, and repairing of surfaces affected by that work.
2. Do not cut supporting members of any floor, wall, or the building structure. If this is necessary, cut only at locations and in such manner as required by the work, without affecting structural integrity, and as approved by the Consultant/Owner.
3. Repair all openings and surfaces made in the process of installing the new work with the type of material removed, by tradesmen expert in the type of repair required.

4. Provide fire barriers around all components in openings which penetrate fire separations. The fire barrier medium provided shall make the fire separation equal to or better than the one which was cut away. All materials shall be CSA approved and UL listed.

5. All floor saw-cutting and drilling required for electrical services shall be performed within hours approved by the Owner. Prior written notice of minimum 72 hours must be given to the Owner and Consultant.

3.8 CONCRETE WORK

1. Coordinate and supervise the work for the provision of the concrete pads for equipment, as shown on the drawings.

3.9 FIRE STOPPING

1. Where cable trays, cables or conduits pass through floor and fire rated walls, pack space between wiring and sleeve and seal with caulking compound conforming to CGSB 19-GP-9Ma AMDT - Oct-80.

2. For conduit, cable tray, and cable penetrations of the fire rated floors and walls, provide an ULC-classified and FM-approved fire seal system to maintain the integrity of the fire separation.

3. Fill void around conduit, tray or cable openings with silica fibre panels and seal both sides with fire retardant elastomeric coating, in accordance with manufacturer's instructions.

3.10 PAINTING AND FINISHING

1. All hangers, channels, conduits, etc. shall be delivered to the site galvanized after fabrication and all metal cuts and finishes damaged on the job shall be painted to match.

2. All equipment and materials shall be stored in a dry, clean location, and covered if necessary to preserve factory finish.

3. Where equipment and material is designated unfinished, all exposed metal work, with the exception of chromed locks and hardware, shall be left with a suitable prime coat finish.

4. Painting of equipment and material requiring a finished coat or touch up after installation shall be carried out wherever required. This does not apply to the making good of damaged factory finishes which shall be done by the Electrical Contractor.

3.11 EQUIPMENT IDENTIFICATION

1. Identify electrical equipment with laminated plastic nameplates.

2. Nameplate colours shall be as follow:

    1. Equipment on utility (normal) power: white letters on black background

    2. Equipment on standby power (generator): white letters on orange background

    3. Equipment on uninterruptible power: (UPS): white letters on blue and purple background (blue for one bus, purple for the other bus)

3. Nameplate text shall be in one of three sizes, as follows:

    1. 12 mm: switchboards and main distribution branch devices

    2. 6 mm: distribution transformers, branch devices in switchboards, panelboards other than those for local lighting and convenience power

3. 3 mm: local panelboards, branch devices in larger panelboards, miscellaneous disconnects, starters, junction boxes, etc.

4. Nameplates shall be secured with screws or rivets.

5. Wording on nameplates to be approved by Owner and/or Consultant prior to manufacture.

6. Allow for average of twenty-five (25) letters per nameplate.

7. Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage rating, power flow directions.

8. Disconnects: indicate equipment being controlled and voltage.

9. Terminal cabinets and pull boxes: indicate system, voltage, and power flow direction.

3.12 WIRING IDENTIFICATION

1. 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.

2. Maintain phase sequence and colour coding throughout.

3. Colour code: in accordance with the Code.

4. Use colour coded wires in communication cables, matched throughout system.

3.13 CONDUIT AND CABLE IDENTIFICATION

1. Colour code conduits, boxes, and metallic sheathed cables.

2. Code with plastic tape or paint at points where conduit or cable enters or exits wall, ceiling, or floor, and at 10m intervals.

3. Label all conduits using "P-Touch" or paint at every entry or exit of wall, ceiling and at 10m intervals.

4. Colours: 25mm wide prime colour and 15mm wide auxiliary colour. Prime colours shall be:

Primary Colours		**Auxiliary Colours**	
31 V to 250 V	blue	Normal power	none
251 V to 750 V	yellow	Emergency power	orange
Communication systems	green	Uninterruptible power	white/black

3.14 WIRING TERMINATIONS

1. Lugs, terminals, screws used for termination of wiring shall be suitable for copper conductors, according to the material of the wiring being terminated.

2. Electrical Contractor shall provide cable lugs, terminals, screws, etc. required for wiring terminations.

3.15 MANUFACTURER'S AND APPROVAL LABELS

1. Provide visible and legible labels after equipment is installed.

3.16 WARNING SIGNS

1. Provide warning signs to meet requirements of Electrical Inspection Authority and any Authority having jurisdiction.

3.17 AS-BUILT ELECTRICAL DRAWINGS

1. Prepare marked-up drawings based on the Single Line Diagram and Layout provided by Consultant.
2. Indicate changes made during construction.
3. Display Single Line Diagram in frame of size no smaller than 600 mm x 900 mm, protected by glass cover or laminated on rigid backboard. Locate in Main Electrical Room and in the new Server Room on 3rd floor.

3.18 TESTING AND COMMISSIONING

1. Provide testing and commissioning of all equipment and systems installed.
2. Major equipment shall be factory tested at the manufacturer's facility before shipping to site, per manufacturer's specific procedures. Certified factory tests reports shall accompany the shipped equipment.
3. Arrange and pay for services of manufacturers' factory service technicians to supervise start-up of installation, check, adjust, balance, and calibrate components, wherever required.
4. Resolve all issues discovered at commissioning stage before placing the systems in service.

3.19 OPERATOR TRAINING

1. Instruct Owner and operating personnel in the operation, care, and maintenance of equipment.
2. Provide an outline of the training material to the Owner and Consultant for review prior to delivering the training.
3. Prepare training material with a level of detail adequate for each type of equipment/system installed. Material to be made available to the attendees in printed format for the training sessions and in digital format (CD or other convenient storage media) for future reference.
4. Conduct "classroom" training followed by "hands-on" training. Demonstrate the operation of each equipment/ system and its features. Enlist the assistance of manufacturers' representatives where appropriate.
5. Provide these services for such period, and for as many visits, as necessary to ensure that operating personnel are conversant with all aspects of equipment operation and care. Obtain written acceptance of operating personnel's understanding of the systems.

3.20 CLEANING

1. During the performance of the work and on completion, remove from the site and premises all debris, rubbish and waste materials caused by the performance of the work for this contract. Remove all tools and surplus materials after acceptance of the work, to the Owner and/or Consultant's satisfaction.
2. Vacuum all equipment thoroughly at the time of final acceptance of the work. Clean plastic components and exposed components of lighting fixtures in accordance with the manufacturer's recommendation.
3. Deep-clean sensitive equipment outside and inside, including the enclosures of UPS modules:
    1. Remove loose dust, dirt, and particles using a vacuum-type cleaner with non-metallic attachments and hoses. Do not blow equipment out with compressed air as it will likely spread contamination and damage insulation.

2. Use dry, clean, lint-free cloth or soft brush, free of oil, grease, and metallic deposits, to wipe internal equipment components.
3. Where liquid cleaners are required, use a barely moistened cloth (not wet) with a nonflammable solvent for wiping. Solvents used for cleaning of electrical equipment should be selected carefully to ensure compatibility with materials being cleaned.
4. Do not use spray cleaners, unless specified by the equipment manufacturer, to avoid leaving residues that may cause damage or interfere with electrical or mechanical functions or compromise the integrity of insulation surfaces.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

1. This section describes the requirements for a Short-circuit/Coordination Study and Arc Flash Hazard Analysis to cover the new electrical system installed under this contract.
2. The above studies shall be prepared by a specialized firm (or equipment manufacturer) on behalf of the Electrical Contractor.
3. The studies shall be completed before the commissioning of the new electrical power distribution system.

1.2 REFERENCES

1. Canadian Standards Association (CSA)
    1. CSA Z462 – Workplace Electrical Safety
2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    1. IEEE 141 - Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
    2. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
    3. IEEE 399 - Recommended Practice for Industrial and Commercial Power System Analysis
    4. IEEE 1015 - Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems
    5. IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations
3. American National Standards Institute (ANSI):
    1. ANSI C37.13 - Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
    2. ANSI C 37.41 - Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories
    3. ANSI C37.5 - Methods for Determining the RMS Value of a Sinusoidal Current Wave and Normal-Frequency Recovery Voltage, and for Simplified Calculation of Fault Currents
4. The National Fire Protection Association (NFPA)
    1. NFPA 70 - National Electrical Code, latest edition
    2. NFPA 70E - Standard for Electrical Safety in the Workplace

1.3 SUBMITTALS

1. The short-circuit and protective device coordination studies shall be submitted to the Consultant prior to testing and commissioning the new equipment.

2. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. Submit three (3) hard copies and three (3) CD's of the report, complete with section containing the computer printout of the short-circuit input and output data.

3. The report shall include the following sections:

    1. Executive Summary including source of information and assumptions made
    2. Purpose, basis, scope, and descriptions, of the study
    3. Single line diagram showing protective device ampere ratings and associated designations, cable size and lengths, transformer kVA and voltage ratings, motor and generator kVA ratings, and switchgear/switchboard/panelboard designations
    4. Tabulations of the worst-case calculated short circuit duties as a percentage of the applied device rating (automatic transfer switches – if installed, circuit breakers, fuses, etc.); the short circuit duties shall be upward-adjusted for X/R ratios that are above the device design ratings
    5. Protective device time versus current coordination curves with associated one line diagram identifying the plotted devices, tabulations of ANSI protective relay functions and adjustable circuit breaker trip unit settings
    6. Fault study input data, and current calculations including a definition of terms and guide for interpretation of the computer printout
    7. Incident energy and flash protection boundary calculations
    8. Comments and recommendations for system improvements, where needed.

1.4 QUALIFICATIONS

1. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Professional Electrical Engineer licensed in Ontario and skilled in performing and interpreting power system studies.

2 Products

2.1 SCOPE OF STUDY

1. The coordination study shall include all electrical protective devices beginning with (and inclusive of) the utility company's feeder protective device, down to and including all branch circuit breakers and motor starters.

2. The study shall also include variable frequency drives, power factor correction equipment, harmonic filters on UPS equipment, transformers and protective devices associated with variable frequency drives, standby generators, and distribution switchgear.

3. The study shall generally be limited to the new system installed; however, where the new system interfaces with the existing system (e.g. existing switchboard fed by the new system), the study shall also investigate coordination with existing devices and recommend settings as necessary to ensure it.

2.2 DATA COLLECTION

1. Contractor shall furnish all field data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data. The Contractor shall expedite collection of the data to eliminate unnecessary delays and assure completion of the studies as required for final approval of the study prior to the commissioning of the system.
2. Load data utilized shall include existing and proposed loads obtained from Contract Documents provided by Owner or Contractor.
3. Include in the study fault contribution of motors, with motors < 50 hp grouped together. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.3 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

1. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standards 141, latest edition.
2. Transformer design impedances and standard X/R ratios shall be used when test values are not available.
3. Provide the following:
    1. Calculation methods and assumptions
    2. Selected base per unit quantities
    3. One-line diagram of the system being evaluated with available fault at each bus, and interrupting rating of devices noted
    4. Source impedance data, including electric utility system and motor fault contribution characteristics
    5. Typical calculations
    6. Tabulations of calculated quantities
    7. Results, conclusions, and recommendations
4. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
    1. Local utility supply points
    2. Normal (Utility) Main Switchboard (600 V, 3000 A)
    3. Standby generators Emergency (Standby) Switchboards ES-A and ES-B
    4. Automatic transfer switches (600 V, 800 A)
    5. UPS input
    6. UPS output
    7. Static Transfer Switches
    8. Critical Switchboard (600 V, 1000A)
    9. New Power Distribution Units

5. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.

6. Protective Device Evaluation:

    1. Evaluate equipment and protective devices and compare to short circuit ratings

    2. Adequacy of switchgear, motor control centers, and panelboard bus bracing to withstand short-circuit stresses

    3. Adequacy of transformer windings to withstand short-circuit stresses

    4. Cable and busway sizes for ability to withstand short-circuit heating

    5. Notify Consultant in writing, of existing, circuit protective devices improperly rated for the calculated available fault current

2.4 PROTECTIVE DEVICE COORDINATION STUDY

1. Proposed protective device coordination time-current curves shall be graphically displayed on log-log scale paper.

2. Include on each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered.

3. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.

4. Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

5. Plot the following characteristics on the curve sheets, where applicable:

    1. Electric utility's protective device

    2. Low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands

    3. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands

    4. Transformer full-load current, magnetizing inrush current, and ANSI transformer withstand parameters

    5. Conductor damage curves

    6. Ground fault protective devices, as applicable

    7. Pertinent motor starting characteristics and motor damage points

    8. Pertinent generator short-circuit decrement curve and generator damage point

    9. Other system load protective devices for the largest branch circuit and the largest feeder circuit breaker in each motor control center

6. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

2.5 ARC FLASH HAZARD ANALYSIS

1. The arc flash hazard analysis shall be performed according to the equations presented in NFPA70E-2004, Annex D of CSA Z462 and IEEE 1584
2. The short circuit calculations and the clearing times of the phase overcurrent devices shall be retrieved from the short-circuit and coordination study model. .
3. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, panelboards, busway and splitters) where work could be performed on energized parts.
4. The Arc-Flash Hazard Analysis shall include all 600 V locations and significant locations in the 208 V systems fed from transformers equal to or greater than 30 kVA (including transformers built into the power distribution units).
5. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm^2.
6. Arc flash computation shall include both line and load side of main breaker.

2.6 REPORT SECTIONS

1. Input Data:
    1. Utility three-phase and line-to-ground available contribution with associated X/R ratios
    2. Short-circuit reactance of rotating machines with associated X/R ratios
    3. Cable type, construction, size, # per phase, length, impedance and conduit type
    4. Bus duct type, size, length, and impedance
2. Short-Circuit Data:
    1. Source fault impedance and generator contributions
    2. X to R ratios
    3. Asymmetry factors
    4. Motor contributions
    5. Short circuit kVA
    6. Symmetrical and asymmetrical fault currents
3. Recommended Circuit Breakers Settings:
    .1 Adjustable pickups and time delays (long time, short time, ground).
    .2 Adjustable time-current characteristic.
    .3 Adjustable instantaneous pickup.
    .4 Recommendations on improved trip systems, if applicable.
4. Incident energy and flash protection boundary calculations.
    1. Arcing fault magnitude
    2. Device clearing time

3. Duration of arc
4. Arc flash boundary
5. Working distance
6. Incident energy
7. Hazard Risk Category
8. Recommendations for arc flash energy reduction.

3 Execution

3.1 FIELD ADJUSTMENT

1. Adjust protective device settings according to the recommended settings table provided by the coordination study. Field adjustments shall be completed by the party retained to commission the low voltage switchgear (could also be the engineering services division of the equipment manufacturer).
2. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.
3. Notify Consultant in writing of any required major equipment modifications.
4. Following completion of all studies, acceptance testing and startup by the field engineering service division of the equipment manufacturer, a 2-year warranty shall be provided on all components manufactured by the engineering service parent manufacturing company.

3.2 ARC FLASH WARNING LABELS

1. Provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
2. The label shall have an orange header with the wording, "WARNING, ARC FLASH HAZARD", and shall include the following information:
    1. Location designation
    2. Nominal voltage
    3. Flash protection boundary
    4. Hazard risk category
    5. Incident energy
    6. Working distance
    7. Engineering report number, revision number and issue date
3. Labels shall be machine printed, with no field markings
4. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
5. For each 600 V and applicable 208 V panelboards and disconnects, one arc flash label shall be provided.
6. For each low voltage switchboard, one arc flash label shall be provided

7. For each UPS, STS, PDU, one flash label shall be provided

8. Labels shall be field installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

3.3 ARC FLASH TRAINING

1. The equipment vendor shall train personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). Maintenance procedures in accordance with the requirements of CSA Z462, Workplace Electrical Safety, shall be provided in the equipment manuals. The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET).

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

1. CSA C22.2 No.0.3, Test Methods for Electrical Wires and Cables.
2. CSA C22.2 No. 35, Extra-Low-Voltage Control Circuit Cables, Low-Energy Control Cable, and Extra-Low-Voltage Control Cable.
3. CSA C22.2 No. 38, Thermoset-Insulated Wires and Cables (Tri-National Standard, with UL-44 and ANCE NMX-J-451).

PART 2 - PRODUCTS

2.1 BUILDING WIRES

1. Cable: to CSA C22.2 No. 38.
2. Conductors: stranded for #8 AWG and larger. Minimum size: #12 AWG.
3. Copper conductors (120/208V): size as indicated, with 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.
4. Copper conductors (600V): size as indicated, with 1000V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 CONTROL CABLES

1. Type LVT: soft annealed copper conductors, with thermoplastic insulation, and outer covering of thermoplastic jacket.
2. Low energy 300V control cable: solid annealed copper conductors sized as indicated, with insulation type T90 Nylon.

2.3 TECK CABLES

1. Cable: to CAN/CSA-C22.2 No.131.
2. Conductors: copper
3. Circuit conductors: copper, size as indicated.
    1. Insulation: Chemically cross-linked thermosetting polyethylene rated Type RW90, 1000V
    2. Inner jacket: PVC
    3. Overall covering material: PVC
    4. Armour: aluminum interlocking.

2.4 ARMOURED CABLES

1. Conductors: insulated, copper, size as indicated.
2. Type: AC90, 1000V rated.
3. Armour: interlocking type fabricated from galvanized steel or aluminum strip.
4. Type: ACWU90 - PVC jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No.0.3 with maximum flame travel of 1.2 m

2.5 LOW VOLTAGE POWER CABLE TERMINATIONS

1. High conductivity wrought copper with electro tin-plated finish, long barrel, two-hole compression connectors (lugs) to CSA C22.2 No.65, sized as required for the various conductors.

PART 3 - EXECUTION

3.1 INSTALLATION OF BUILDING WIRES

1. Install wiring in raceways, in trays or exposed in accordance with the relevant Sections of this Division.
2. Do not exceed maximum pulling tension as specified by cable/wire manufacturer.
3. Connect cables as indicated.

3.2 INSTALLATION OF CONTROL CABLES

1. Install control cables in raceways, as indicated, and connect.
2. Ground control cable shield.

3.3 INSTALLATION OF TECK CABLE AND ARMOURED CABLE

1. Install cables, grouping wherever possible on channels.
2. Terminate cables in accordance with manufacturer’s recommendations.
3. Connect cables as indicated.

3.4 FIELD QUALITY CONTROL

1. Perform tests using qualified personnel and the necessary instruments and equipment.
2. Identify each phase conductor of each feeder.
3. Check each feeder for continuity, short circuits, and grounds.
4. After installing cable but before splicing and terminating, perform insulation resistance test with megger on each phase conductor. Ensure insulation resistance to ground of circuits is not less than 100 megohms.
5. Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
6. Provide Consultant with list of test results showing location at which each test was made, circuit tested and result of each test.
7. Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

1. This section covers the requirements for system and equipment grounding.

1.2 REFERENCES

1. CSA C22.3 No.2, General Grounding Requirements and Grounding Requirements for Electrical Supply Stations.
2. ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.

PART 2 - PRODUCTS

2.1 MATERIALS

1. Conductors: stranded, insulated, soft annealed copper wire, size as indicated on drawings for ground bus, transformers, switchgear, panelboards, and ground connections.
2. Ground bus: copper, size 6 mm x 50 mm complete with insulated supports.
3. Accessories: non-corroding, necessary for complete grounding system, type, size, and material as indicated, including:
    1. Grounding and bonding bushings
    2. Protective type clamps
    3. Bolted type conductor connectors
    4. Bonding jumpers, straps
    5. Pressure wire connectors.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

1. Install continuous grounding system including, conductors, connectors, and accessories in accordance with CSA C22.3 No.2.
2. Install connectors in accordance with manufacturer's instructions.
3. Protect grounding conductors from mechanical injury.

   Use mechanical connectors for grounding connections to equipment provided with lugs.

3.2 FIELD QUALITY CONTROL

1. Perform tests in accordance with Section 26 05 00 - Electrical General Requirements.
2. Perform resistance tests using method appropriate to site conditions and to approval of Consultant and Electrical Safety Authority.
3. Perform test before energizing electrical system.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

1. This section covers the requirements for support systems used with the various power conveyance means used on the project, including cable trays, conduits, and cables.

PART 2 - PRODUCTS

2.1 FASTENINGS AND SUPPORT CHANNELS

1. Support channels shall be U shape, size 40 x 40 mm, 2.5 mm thick, mounted as required to support the various loads.
2. Finish of fastenings, fittings and supports shall be hot dip galvanized or stainless steel; electro-plating is not acceptable as it is promotes formation of zinc whiskers - unacceptable in environments with high airflow velocity and sensitive electronic equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

1. Secure equipment to solid masonry surfaces with lead anchors.
2. Secure equipment to poured concrete with expandable inserts.
3. Secure equipment to hollow walls with toggle bolts.
4. Support equipment, conduit or cables using clips, spring loaded bolts, or cable clamps designed as accessories to basic channel members.
5. Fasten exposed conduit or cables to building construction or support system using straps. Use one-hole steel straps to secure surface conduits and cables 50 mm and smaller and two-hole steel straps for conduits and cables larger than 50 mm.
6. Use beam clamps to secure conduit to exposed steel work.
7. Suspended support systems. support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips; support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
8. For surface mounting of two or more conduits use channels at 1.2 m spacing.
9. Provide metal brackets, frames, hangers, clamps and related types of support structures as required to support conduit and cable runs.
10. Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
11. Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant.
12. Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer’s installation recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

1. This section describes miscellaneous equipment and materials to be used in the electrical installation.
2. The drawings do not necessarily show junction and pull boxes.

PART 2 - PRODUCTS

2.1 SPLITTERS

1. Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
2. Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
3. At least three spare terminals on each set of lugs.

2.2 JUNCTION AND PULL BOXES

1. Welded steel construction with screw-on flat covers for surface mounting.
2. Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.
3. Where wiring from 2 or more sources are contained in or running through pull or junction box, the box shall be labelled with appropriate warning as well as voltage and sources.

PART 3 - EXECUTION

3.1 SPLITTER INSTALLATION

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

3.2 JUNCTION AND PULL BOX INSTALLATION

1. Install pull boxes in inconspicuous but accessible locations.
2. Install pull boxes so as not to exceed 30 m of conduit run, or two 90° bends, between pull boxes.

3.3 IDENTIFICATION

1. Provide equipment identification in accordance with Section 26 05 00.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

1. Canadian Standards Association (CSA)
    1. CAN/CSA C22.2 No.18, Outlet Boxes, Conduit Boxes, and Fittings.
    2. CSA C22.2 No.56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
    3. CSA C22.2 No.83, Electrical Metallic Tubing.
    4. C22.2 NO. 45.2, Electrical Rigid Metal Conduit - Aluminum

1.2 RELATED WORK

1. Comply with the relevant Sections of this and other Divisions of this Specification.

1.3 APPLICATION

1. EMT conduits may be used in all indoor locations, except as excluded herein and provided that it is not susceptible to mechanical injury.
2. Flexible metallic conduit shall be used for the last 1.0 m in connections to vibrating equipment including, but not limited to transformers.
3. Liquid-tight flexible metallic conduit shall be for final connection to equipment.
4. Notwithstanding anything in this Article, a specific direction on the Drawings to use a particular type of conduit shall override this Article.

PART 2 - PRODUCTS

2.1 CONDUIT FASTENINGS

1. One-hole steel straps to secure surface conduits 50 mm and smaller. Two-hole steel straps for conduits larger than 50 mm. “Caddy” clips shall not be used.
2. Beam clamps to secure conduits to exposed steel work.
3. Channel type supports for two or more conduits at 1.2 m oc.
4. Threaded rods, 6 mm diameter, to support suspended channels.

2.2 CONDUIT FITTINGS

1. Fittings: manufactured for use with conduit specified. Coating: same as conduit.
2. Factory "ells" where 90° bends are required for 25 mm and larger conduits.
3. Compression watertight connectors and couplings for EMT exposed to moisture.
4. Set-screw fittings for EMT conduit where acceptable.

2.3 FISH CORD

1. Install Polypropylene cord in each conduit.

PART 3 - EXECUTION

3.1 INSTALLATION

1. Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
2. Conceal conduits except in unfinished areas.
3. Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
4. Mechanically bend steel conduit over 20 mm diameter.
5. Install fish cord in empty conduits.
6. Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
7. Dry conduits out before installing wire.
8. Remove burrs at conduit ends prior to installing wire.

3.2 SURFACE CONDUITS

1. Run conduits parallel or perpendicular to building lines.
2. Group conduits wherever possible on channels.
3. Do not pass conduits through structural members.
4. Do not locate conduits less than 75 mm parallel to hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

1. Run parallel or perpendicular to building lines.
2. Do not install horizontal runs in masonry walls.

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

.1 Submit product data (shop drawings) showing electrical details of transformers.

.2 Include KVA rating, temperature rise, detailed enclosure dimensions, primary and secondary nominal voltages, primary voltage taps, no load and full load losses, impedances, unit weight, warranty.

1.2 REFERENCES

.1 CSA 22.2 No. 47, Air-cooled Transformers (Dry type)

.2 ANSI/NEMA ST 20-Dry Type Transformer for General Applications

.3 IEEE C57.110

1.3 STORAGE AND HANDLING

.1 Store and handle in strict compliance with manufacturer's instructions and recommendations

.2 Protect from potential damage from construction operations.

.3 Store so condensation will not form on or in the transformer housing and if necessary, apply temporary heat where required to obtain suitable service conditions.

.4 Handle transformers using proper equipment for lifting and handling; when necessary, use lifting eye and/or brackets provided for that purpose.

PART 2 - PRODUCTS

2.1 TRANSFORMER

.1 Nameplate rating: 600 V primary, 208/120 V secondary, linear load, 60Hz.

.2 Standard impedance at 60Hz: 6.5%

.3 Three-phase, common core construction. Convection air cooled

.4 Insulation Class: 220°C system

.5 Temperature rise: 150°C

.6 Taps: 2 x ± 2.5% (2FCAN, 2FCBN)

.7 Core made of high grade non-aging silicon steel laminations or better

.8 Coil conductors: continuous aluminum windings, with terminations brazed or welded

.9 Impregnation: vacuum impregnated polyester resin.

.10 Inrush current: 10 times full load rating (max.)

.11 Sound level to meet NEMA ST-20

.12 Enclosure: ventilated, Type 1, for floor or wall mounting.

.13 Finishes: ANSI 61 Grey

.14 Anti-vibration pads shall be used between the core and the enclosure

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Electrical General Requirements.

2.3 MANUFACTURER

.1 Dry-type transformer shall be the product of Delta Transformer, Hammond, Polygon or equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Mount dry type transformer on floor or suspended from structure, as shown on the drawings.

.2 Ensure adequate clearance around transformer for ventilation.

.3 Install transformer in level upright position.

.4 Remove shipping supports only after transformer is installed and just before putting into service.

.5 Loosen isolation pad bolts until no compression is visible.

.6 Make primary and secondary connections in accordance with wiring diagram.

.7 Energize transformer after installation is complete.

3.2 COMMISSIONING

.1 Take Infrared picture to verify connection accuracy.

.2 Before applying loads verify secondary voltages and if necessary adjust secondary taps.

.3 Commissioning Report on transformers shall include:

.1 primary and secondary voltages

.2 primary and secondary total harmonic distortion for voltage and current

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

1. The work described in this specification covers the supply and installation of power and distribution panelboards shown on the drawings. Included are SWBD-P1XAA, DP-P1XAA, DP-A, DP-B, RP-3DP, RP-3LA, RP-UPS-A, and RP-UPS-B.

1.2 REFERENCE STANDARDS

1. CSA C22.2 No. 29

1.3 SUBMITTALS

1. Submit product data (shop drawings).
2. Drawings shall include electrical detail of each panel, feeder and branch breaker type, quantity, ampacity, short circuit rating, and enclosure dimensions.

1.4 PLANT ASSEMBLY

1. Install circuit breakers in panels before shipment.
2. In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

PART 2 - PRODUCTS

2.1 SWITCHBOARD

.1 Three-section lineup, free standing, indoor type, 600 V, 1200A, 3 phase, 3 wire.

.2 Main breakers: power circuit breakers, fixed type, 1200A frame, 1000A sensor (rating plug), with key interlocks configured so that only one breaker can be closed at any time. NOTE: Initially, the interlocking shall be between the Mobile Generator Breaker and the existing Stationary Generator Breaker (in Generator Swbd. on 28th Floor).

.3 Digital power meter c/w CTs and PTs (if required) installed on the load bus upstream of all feeder breakers. Parameters measured: V, A, kW, kVAR, kVA, kWhr, p.f., as a minimum.

.4 Feeder breakers: moulded case type, ratings as shown, complete with electronic trip units

2.2 POWER AND DISTRIBUTION PANELS

1. All panels shall be the product of a single manufacturer.
2. Bus and breakers shall have ratings and interrupting capacities as indicated on drawings.
3. Unless otherwise specified, all panels shall have copper bus bars rated for the withstand capacity indicated.
4. Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number.

5. Panels shall contain mains, ground and neutral busses, number of circuits, and number and size of branch circuit breakers as indicated on drawings.
6. Provide 2 (two) keys for each panels and key panels alike.
7. The mains shall be suitable for bolt-on breakers.
8. The trim and door shall be finished with baked air-dried grey enamel.

2.3 BREAKERS

1. Breakers rated 100 A and over installed in power panels shall have electronic trip units.
2. Breakers rated below 100 A installed in distribution panelboards shall have thermal and magnetic trip units.
3. Bolt-on moulded case circuit breakers shall be quick-make, quick-break type, for manual and automatic operation, with temperature compensation for 40°C ambient.
4. Common-trip breakers: with single handle for multi-pole applications.
5. Provide lock-on devices for each breaker as indicated on the drawings.

2.4 EQUIPMENT IDENTIFICATION

1. Provide nameplate for each panel.
2. Complete circuit directory with typewritten legend showing location and load of each circuit.

2.5 MANUFACTURERS

1. Eaton Electric
2. Schneider Electric
3. Siemens
4. ABB

PART 3 - EXECUTION

3.1 INSTALLATION

1. Locate switchboard and panels where indicated and mount securely, plumb true and square, to adjoining surfaces.
2. Validate phase rotation after power up before connecting loads.
3. Connect loads to circuits as indicated.
4. Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

PART 1 - GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

1. Submit electronic shop drawings and product data in accordance with Section 26 05 00.

PART 2 - PRODUCTS

2.1 SWITCHES

1. Line Switches:
    1. 20 A, 120 V, switches; type as shown on drawings to CSA-C22.2 No.55.
    2. Manually operated general purpose AC switches with following features:
        1. Terminal holes approved for No. 10 AWG wire; silver alloy contacts.
        2. Urea or melamine molding for parts subject to carbon tracking.
        3. Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
2. Switches of one manufacturer throughout project.
3. Acceptable materials: Hubbell, Leviton or equivalent.
4. For specialty switches (occupancy sensor type), refer to Section 26 50 00, Lighting Equipment.

2.2 RECEPTACLES

1. CSA type (ratings and configurations) as indicated on drawings, with following features:
    1. Urea molded housing, colour as follows:
        1. Receptacle on standby power (generator): red
        2. Receptacle on uninterruptible power (UPS): grey
    2. Suitable for No. 10 AWG for back and side wiring.
    3. Break-off links for use as split receptacles.
    4. Eight back wired entrances, four side wiring screws.
    5. Triple wipe contacts and riveted grounding contacts.
2. Receptacles of one manufacturer throughout project.
3. Acceptable materials: Hubbell, Leviton or equivalent.

2.3 SPECIAL WIRING DEVICES

1. Special wiring devices: telephone jacks, RJ-11.
2. Data outlets: RJ-45.

2.4 GALVANIZED STEEL OUTLET BOXES

1. One-piece electro-galvanized construction.
2. Utility boxes for outlets connected to surface mounted EMT conduit, minimum size 102 x 54 x 48 mm.
3. 102 mm square or octagonal outlet boxes for lighting fixture outlets.

2.5 COVER PLATES

1. Cover plates for wiring devices.
2. Cover plates from one manufacturer throughout project.
3. Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
4. Stainless steel cover plates cover plates for wiring devices mounted in flush-mounted outlet box.
5. Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
6. Cover plates in finished areas shall be white plastic, except for above-counter in serveries and wood finishes, which shall be black.

PART 3 - EXECUTION

3.1 INSTALLATION

1. Switches:
    1. Install single throw switches with handle in "UP" position when switch closed.
    2. Install switches in gang type outlet box when more than one switch is required in one location.
    3. .. Mount switches at 1200 mm height above the floor.
2. Receptacles:
    1. Install receptacles in gang type outlet box when more than one receptacle is required in one location.
    2. Mount receptacles at 1200 mm height.
3. Cover plates:
    1. Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
    2. Install suitable common cover plates where wiring devices are grouped.
    3. Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
    4. Identify with P-touch label, showing source and circuit number

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

.1 Submit product data (shop drawings) showing electrical detail of each disconnect switch, quantity, rating, and enclosure dimensions.

1.2 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 26 05 00.

.2 Six spare fuses of each type and size installed.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Fused, horsepower rated disconnect switch in CSA Enclosure 1, size as indicated.

.2 Mechanically interlocked door to prevent opening when handle in ON position, with provision for padlocking in off switch position by three locks.

.3 Quick-make, quick-break action.

.4 ON-OFF switch position indication on switch enclosure cover.

.5 Fuse holders: suitable without adaptors, for type and size of fuse indicated.

2.2 FUSES

.1 HRCI-J fuses (formerly Class J): time delay, capable of carrying 500% of its rated current for 10 s minimum.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Electrical General Requirements.

.2 For each disconnect switch provide nameplate indicating load controlled.

2.4 MANUFACTURERS

.1 Eaton Electric (Cutler-Hammer)

.2 Schneider Electric

.3 Siemens

.4 ABB

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses.

.2 Ensure correct fuses fitted to assigned electrical circuit.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

1. This specification covers three uninterruptible power supply systems (UPS) consisting of two (2) 40 kVA modules (UPS-1, UPS-2), plus associated batteries, as further described herein.
2. The work under this section also covers delivery to the site and unloading of the UPS systems and their batteries, moving to the installation location, and the installation, testing and commissioning of all systems.
3. The Contractor shall also provide the services of a factory-trained technician to perform the following tests at the site, after the UPS systems have been installed:
    1. Visual inspection of mechanical (physical) and electrical installation
    2. Load bank test for each module for 4 hours.
    3. Forward and reverse transfer to/from bypass
    4. Operation on generator AC supply
    5. Training of operating personnel upon acceptance of the work.

1.2 REFERENCE STANDARDS

1. The UPS and all associated components shall be manufactured in accordance with the following applicable standards:
    1. CSA 22.2 No. 107.1
    2. IEEE 587-1980 / ANSI C62.41
    3. UL Standard 1778, Uninterruptible Power Supply Equipment
    4. NFPA 70, NEMA and OSHA

1.3 QUALIFICATIONS

1. The manufacturer of the UPS systems shall have produced equipment of these ratings for at least ten (10) years; the equipment must be installed in similar critical facilities and have a history of reliable operation of at least five (5) years.
2. The manufacturer of the UPS systems shall be certified to conform to Quality Standard ISO 9001 for the design and manufacturing of power protection systems for computers and other sensitive electronics.
3. The manufacturer shall have at least one (1) qualified UPS service provider able to support the installation site in Toronto, Ontario.
4. The service provider shall maintain a permanent stock of parts and shall have the ability to deliver these parts to the Metro Hall site within twenty-four (24) hours of a request for parts replacement. The service provider's response time following a service call shall be no longer than twelve (12) hours.

1.4 SUBMITTALS

1. Submit product data in electronic format for review.
2. The product data shall be technical literature (catalogue sheets) depicting the products proposed. Sales literature is not acceptable.
3. Provide the following information:
    1. Weight and dimensions of all shipping units.
    2. Detailed description of system and its components including equipment layout drawing, one-line diagram, system configuration, heat dissipation, environmental operating ratings, capacity, guaranteed efficiency; rating of all circuit breakers and fuses; metering and alarm devices, communications interface
    3. Make, type, capacity and voltage of battery, manufacturer's certified warranty, complete with conditions and limitations
    4. An itemized list of equipment to be furnished, and detailed information of all deviations from these specifications.
    5. Location of nearest office staffed with factory trained service personnel; guaranteed response time for a qualified service representative to be on site following an emergency service call at any time.
    6. Warranties for each piece of equipment to be furnished
4. Submit for review the following shop drawings (system configuration drawings):
    1. Single line diagrams indicating general arrangement of all components, interconnecting wiring, and bus connection diagrams; identification of all circuit breakers and fuses by location, size, type, and rating;
    2. Functional relationship of various components with description and electrical ratings.
    3. Battery capacity calculation, its short circuit capacity, certified discharge curve in amperes, cell detail – for both types of battery.
    4. Layouts of all metering and alarm devices, with terminal locations for power and control cabling.
    5. Data of maximum sound pressure level of UPS modules at full load measured one metre (1.0 m) around enclosure using dBA scale.
    6. Voltage levels and rise time of steep wave front transients that cause system to malfunction.
    7. Recommended spare parts list, location of nearest parts' depot stocking suitable parts, and time required to deliver these to site.
    8. CD with the same information in PDF format. The CD shall also include the dimensional drawings (plan and views – left, right, front and rear) in AutoCAD format.
5. Submit with equipment delivered:
    1. As-built version of shop and installation drawings and instructions
    2. Special tools and spare parts with applicable lists and instructions

3. Three (3) sets of Operating and Maintenance Manuals for system
4. Outline of training program to be delivered to Owner's operating and maintenance staff.

6. The above as-built information shall be organized in a logical, easy to follow manner, and shall be assembled in a binder containing a table of contents and sections (with dividers or tabs) for each of the components of the system proposed. It shall also be provided on a CD in PDF format.

1.5 OPERATION AND MAINTENANCE DATA

1. Provide three (3) copies of Operation and Maintenance Manual with equipment delivered. In addition, provide CD containing the same information in PDF format as the printed manual.
2. Include in Operation and Maintenance Manual instructions for units supplied and not general description of units manufactured by supplier, and:
    1. "As Built" drawings produced for this equipment, including such items as component arrangement, wiring and schematic diagrams.
    2. Step-by-step instructions for operating and maintenance applicable to rectifier, inverter, battery, static switch, controls, protective devices, meters, alarms, indicators and all other components.
    3. Illustrations, schedules, identification of equipment, terminals, wiring connections
    4. Safety precautions
    5. Maintenance and adjustment procedures and lifting and jacking instructions
    6. Certified copy of factory test results
    7. Maintenance instructions and schedules
    8. Fault locating guide.
3. If standard literature is incorporated into the Operation and Maintenance Manual, any irrelevant information shall be deleted, or suitably noted.
4. In the event of modifications to the equipment during the installation and final testing the manuals shall be revised accordingly and re-issued.

1.6 MAINTENANCE MATERIALS

1. Provide to the Owner the following maintenance materials:
    1. Air filter replacement elements (for ventilation fans)
    2. Fuses for control panel, 2 of each size
    3. One spare ventilation fan for each module.

1.7 REGULATORY REQUIREMENTS

1. Complete assembly of UPS equipment on site shall meet approval of local Electrical Safety Authority, including integral means for individual disconnection of outputs, together with appropriate warning signs.

1.8 SOURCE QUALITY CONTROL

1. Perform inspection and functional tests to determine that switches, status lights, alarms, displays and all other operational characteristics of the system function as specified.
4. Test equipment for operation from AC power source, battery power source and bypass power source.
5. Perform no-load, half-load, full-load and over-load tests.
6. Record Input voltage, frequency, amps, kW, kVA, p.f.; output voltage, frequency, amps, kW, kVA, p.f.; D.C. volts, amps; harmonic content of output, effect of input transients, noise levels.
8. Dismantling and shipment from factory test bay shall not occur until deficiencies have been corrected and the system has been re-tested to the satisfaction of the Consultant and/or Owner and certified as being acceptable for shipment.

1.9 WARRANTY AND MAINTENANCE

1. The manufacturer's standard warranty for the UPS systems shall be for a period three (3) years from the date of initial placing in service and shall include two (2) preventative maintenance visits per year. Acceptance shall be deemed to occur following the successful testing and commissioning on site, as shown by the date on the certified Commissioning Report.
2. The VRLA batteries shall be covered by a full parts and labour warranty as follows:
    1. full replacement (non-prorated) for the first 2 years
    2. pro-rated for the balance of life between the 3rd and the 10th year
3. Provide a formula for calculating the pro-rated credit to be given to the Owner towards the purchase of a new battery for cases where a battery fails before its guaranteed useful service life.
4. Any equipment that becomes defective within the Supplier's warranty period, shall be repaired to the Owner’s satisfaction, within two (2) days from the time of the request. A report on deficiencies must be supplied to the Owner for each instance when a warranty repair is performed.
5. Warranty shall include repair parts, labour, reasonable travel expenses, and expendables used during repair. Manufacturer shall correct any deficiencies in equipment which occur during the warranty period at no additional cost to Owner.
6. After expiration of warranty, the manufacturer shall be prepared to take on an annual maintenance contract including emergency repair services and four quarterly diagnostic checks to be done at times scheduled by Owner.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

1. The UPS systems shall include:
    1. Two UPS modules (UPS-1, UPS-2), each sized 40 kVA, single input, for operation in “distributed redundant” configuration
    2. Two (2) battery cabinets (strings) to provide capacity to supply the full load per UPS for 12 minutes at end of life
2. Each UPS module shall contain, without being limited to, the following components:
    1. Rectifier/battery charger
    2. Solid state inverter
    3. Static bypass switch, fully rated (for continuous operation at 125% load)
    4. Protection devices, metering instruments (monitoring display), indicating lights, alarms
    5. Circuitry for synchronization and bypass control
    6. Communications interface for remote monitoring.

2.2 SYSTEM OPERATION

.1 Each UPS system shall operate in conjunction with the building electrical system and the standby power system to provide regulated, conditioned, and uninterrupted power, within specified tolerances, to the critical load.

.2 In normal operating conditions, when each UPS system is supplied from the AC source, incoming AC power is continuously conditioned and supplied to the critical load, while DC power from rectifier maintains battery in a fully charged condition. The two 40 kVA UPS modules each supply their own load through an output panel connected.

.3 Upon failure or deterioration of incoming AC power, continuity of conditioned AC power to critical load is maintained; however, in this situation the inverter is supplied DC power from battery only. This continues until AC incoming power is restored or battery is exhausted to a pre-defined level and controls automatically shut UPS system down.

.4 Upon restoration of incoming AC source, system automatically starts to condition power to load and to simultaneously recharge battery at a pre-set rate. If AC power was restored before UPS system shut down, then conditioned AC power to critical load was maintained without interruption. If controls shut UPS system down because battery was exhausted, then system must be re-started manually.

.5 In the event that one UPS fails to provide conditioned AC power, voltage, and frequency within pre-set tolerances due to its malfunctioning or abnormal operating conditions, static bypass switch shall automatically operate and transfer critical load to bypass supply without subjecting critical load to a power interruption, voltage, or frequency variation more than set tolerances.

.6 All above operations shall be automatically indicated, and all malfunctions and abnormal conditions shall automatically be annunciated by specified alarms.

.7 UPS system shall provide continuous conditioned power within specified tolerances to critical load under such conditions as: momentary failure or fluctuation of the incoming supply, long-term interruption of supply, steep wave front transients superimposed on supply voltage, or frequency deviations from any causes.

2.3 SYSTEM REQUIREMENTS

1. UPS-1 and UPS-2 shall be designed to provide 40 kVA / 40 kW each at unity power factor to computer loads, in distributed redundant configuration.
2. Input AC supply is 3 phase, 3 wire + GND, 600 V +10% -15% maximum, frequency 60 Hz ± 5%, power factor from unity to 0.8 lagging in normal conditions.
3. Performance characteristics of system outputs shall be:
    1. 208/120 V, 3 phase, 3 wire + GND, with ± 5% manual adjustment
    2. Voltage regulation: ± 1.0% in all loading conditions and ± 5.0% maximum for 100% step load application
    3. Voltage transient recovery time: 16.67 milliseconds (one cycle) to return to within 0.5% of normal voltage on 100% step load application
    4. Frequency 60 Hz ± 0.1% with control adjustable from ± 1.0 to ± 3.0 Hz, slew rate 1.0 Hz/sec. Maximum
    5. Output voltage distortion shall not exceed 5% THD for 100% non-linear load
    6. Overload capacity: 125% for 10 min., 150% for 1 min., and 200% for 10 cycles
    7. Efficiency: no less than 93% over the full load range.
    8. Capability to operate load with power factor of 0.8 lagging to 0.9 leading.

2.4 ENVIRONMENTAL CONDITIONS

1. UPS systems shall withstand any combination of following conditions without damage or degradation of its operating characteristics:
    1. temperature between 0° and 40°C (operating), and
    2. relative humidity of 0% to 95%.
2. Noise generated under any operating conditions shall not exceed 65 dBA at 1 metre.

2.5 EQUIPMENT

1. UPS equipment shall be housed in front access sheet metal enclosures, free standing, ventilated, with key lockable doors. All cabinets shall match in style, appearance, height, depth, and colour, and shall be suitable for installation side-by-side. Input and output power connections shall be provided at top only. Suitable casters and levelling pads shall be included.
2. Cabinets shall be suitable for pallet mounting, to be handled by jack or forklift.

3. Adequate ventilation shall be provided to ensure that all components are operated within their environmental ratings. Cooling fans shall be redundant. Fans shall be equipped with electronic sensors, or acceptable alternative, connected to initiate, in event of a fan failure, audible and visual alarms at module control panels. Temperature sensors shall be provided to monitor temperature of critical components. Upon detection of temperatures more than component manufacturer's recommended working temperature, sensors shall cause audible and visible alarms to operate at module control panels.

4. All terminal lugs, fittings and cabinet interconnections shall be provided. All wiring and coding shall conform to requirements of the Canadian Electrical Code. Wiring harnesses shall be bound with tie-wrap and strain relief provided where necessary. All wiring shall be colour-coded and identified with permanent markers at both ends. Wiring shall be protected in a manner which separates power and control wiring. Conductors shall be copper.

5. UPS module chassis shall be provided with an equipment ground system terminal.

6. Equipment shall be of a proven design and standard manufacture, except where optional features are specified in detail. Materials and parts shall be new, of current manufacture, of a high grade and free from defects and imperfections.

7. Equipment shall be designed for automatic, unattended operation; however, provisions shall be made for easy periodic checking, servicing, adjusting, troubleshooting and parts replacing.

8. Active electronic devices shall be solid-state. Semi-conductor devices shall be hermetically sealed. Rotating machinery shall not be used except for cooling fans. Relays shall be dust tight. Maximum working voltages, circuit and di/dt of solid-state power components and electronic devices shall not exceed 75% of rating established by their manufacturer. Operating temperature of solid-state components shall not be greater than 75% of their ratings. Electrolytic capacitors shall be computer grade and be operated at no more than 90% of their voltage rating and shall not contain PCB's. Surge protection shall be provided for both input and output systems.

9. Equipment shall be designed to minimize conducted and radiated electromagnetic interference (EMI). Computer systems or other similar electronic equipment shall not affect nor be adversely affected by UPS equipment when connected to or installed adjacently.

10. Input moulded-case circuit breakers for protection and AC source disconnection shall be of frame and trip rating to suit nominal load, overload, and shall have an interrupting capacity of minimum 42 kA.

11. Battery moulded-case circuit breakers shall be of frame and trip rating to suit DC voltage, charging and discharging currents of the battery, with short-circuit capacity minimum 20% higher than the battery short circuit capacity. The breaker shall open automatically at the minimum permissible DC voltage or when tripped by any other control function. When opened either manually or automatically, no battery voltage shall be present in the system.

12. Output moulded-case circuit breaker shall be of frame and trip rating suitable for stated capacity and conditions of the critical load, required overload, min. 42 kA short-circuit current available, and for load disconnection.

13. Plug-in printed circuit boards shall be protected from being inserted into wrong locations by means of mechanical interlock arrangement.

14. The system shall include necessary devices to limit the input current inrush, as well as battery charging current-limiting features.

15. Power semiconductors in rectifier/charger and inverter shall be fused with fast acting fuses, so that loss of any one of these will not cause others to fail.

16. Charging rate shall be sufficient to restore battery from discharge to 90% charge within twelve (10) times discharge time (maximum 120 minutes). After battery is recharged, charger shall maintain battery at full charge until next emergency operation. Charging current shall be voltage regulated, filtered to minimize ripples, and limited to safe value.

17. Inverter shall be able to sustain an overload across its output terminals, while supplying any load within its rating. Inverter shall not shut off but shall continue to operate with a current limit of not less than 125% of rated current for at least 10 minutes. If short circuit is sustained, inverter shall shutdown and disconnect automatically from critical load bus. Inverter shall be capable of clearing load branch faults.

18. Output frequency of inverter shall be controlled by an oscillator. Oscillator shall be temperature compensated. Oscillator shall hold inverter output frequency to ± 0.1% for both steady state and transient conditions. Drift shall not exceed ± 0.1% during a 24-hour period. Total frequency deviation, including short time fluctuation and drift shall not exceed ± 0.1% from rated frequency.

19. Inverter shall have fault sensing and a static interrupter or equivalent together with output circuit breaker permitting removal of a faulted unit from system.

2.6 PROTECTION

1. UPS modules shall have own built-in protection as well as for the connected load against power line surges, over-voltage, under-voltage and over-currents at input, over-voltage and voltage surges induced at output terminals by load switching and circuit breaker operation in distribution system.

2. UPS modules shall also have built-in protection against permanent damage and for all predictable types of failures within UPS or load. Fast acting current limiting devices shall be used to protect against failure of solid-state devices. Internal failures in a UPS module shall cause module to trip off-line with minimum damage to module and to provide maximum information to maintenance personnel regarding reason for tripping.

2.7 CONTROLS AND INSTRUMENTATION

1. Each UPS module shall have its own set of controls, displays, alarms and/or indicating lights. Display panel, alarms, controls, and other features shall be of standard manufacture. The following shall be provided as a minimum:

    1. Input voltage, current, frequency, kW, kVA and p.f. indication

    2. Output (inverter) voltage, current, frequency, kW, kVA and p.f. indication

    3. Bypass voltage, current, frequency, kW, kVA and p.f. indication

    4. DC battery voltage, charge/discharge current indication, and minutes of operation available at the current load

5. Display of active system events and historical log of events
6. Mimic screen.

2. Following alarms shall be provided on each UPS:
   1. System normal input power failure
   2. Fuse failures
   3. Inverter failure: overload warning, overload shutdown, inverter over temperature, inverter control power-logic failure
   4. Fan failure
   5. DC alarms: Battery discharging, DC low voltage warning, DC undervoltage shutdown, DC ground fault, DC over voltage,
   6. Input breaker CLOSED or OPEN, module not synchronized with system
   7. Module summary alarm: static switch unable, output undervoltage, output over voltage, critical load on bypass.
3. An audible alarm shall sound when any of above alarms occur.
4. Following controls shall be provided on UPS:
   1. Switch for transferring UPS to bypass
   2. AC output voltage adjuster
   3. Lamp test/reset push button
   4. Horn test/silence push button
   5. Other controls as per manufacturer's standards.
5. The UPS shall incorporate a micro-processor operated test system for trouble indication, troubleshooting, alarm, and maintenance functions.
6. Variances from above list of controls and alarms, due to manufacturer's standard design, may be accepted at the discretion of Owner.

2.8 STATIC BYPASS SWITCH

1. For each UPS module provide a bypass switch and associated controls consisting of SCR's, fuses, circuit breaker, logic system and control wiring in an arrangement to permit easy servicing and troubleshooting without interrupting power flow through UPS system. Power and control wiring and components shall be fully front accessible.
2. Bypass and its controls shall be accommodated in UPS module cabinet.
3. Capacity of bypass assembly shall match that of the UPS module, the prime AC source, DC source, rating and performance characteristics of the inverter, and the AC output requirements specified. Static switch shall be fully rated, have heat sing of adequate capacity to dissipate the heat generated, and shall be fan cooled.
4. SCRs shall have adequate capacity to provide uninterrupted transfer of rated load within computer tolerance for period from signal initiation to main contact closing of bypass breaker.

SCRs shall be capable of withstanding any transient voltage on incoming utility supply without flashover or allowing transient voltage to pass through SCRs when they are not in conduction mode.

5. Upon manual initiation, UPS shall make an uninterrupted bypass transfer of critical load to the bypass source or retransfer from bypass source to UPS power without voltage transients greater than ± 8% maximum with recovery to 100% voltage within 100 milliseconds (6 cycles). UPS shall synchronize with bypass power source if voltage or frequency conditions are within computer tolerance. When quality of bypass power is outside limits of specified input power characteristics, a solid-state system shall prevent manually initiated uninterrupted transfer of critical load between UPS and bypass line.

6. Bypass switch shall provide automatic transfer of critical load to bypass source and back again after inverter supply is restored, without exceeding transient voltage limits. This operating feature shall also function to handle overloads of up to 125%, load faults and inrush currents as necessary. If transfer of load from bypass to inverter fails to hold, a control lockout shall prevent further attempts and shall leave system in bypass supply mode. A visual/audible alarm shall be provided on panel to indicate this condition.

7. After control lockout, retransfer to inverter after inverter supply is restored shall require manual initiation.

8. UPS shall include all required controls to automatically transfer to bypass under the following conditions:

    1. Activation of a master UPS transfer switch.
    2. Failure of an inverter module when load demand exceeds rated capacity.
    3. Low battery condition, if UPS has discharged battery for any reason and normal input power is available to static bypass switch.
    4. When UPS output voltage exceeds specified voltage limits.
    5. When a short circuit persists on critical bus.
    6. Any other UPS problems that would degrade critical bus voltage.

9. If automatic transfer signal is generated for one of above reasons, automatic transfer shall take place only when voltage available on bypass power line is within the tolerance band of both sources.

10. UPS module inverter shall contain its own oscillator. Oscillator shall be designed to be operated free running at 60 Hz ± 0.1%. UPS shall be capable of operating in parallel with the utility power source to accomplish a transfer of critical load from inverter to bypass circuit and vice versa.

2.9 EMERGENCY SHUTDOWN

1. UPS system shall be provided with local emergency shutdown provisions. Activation of the emergency shutdown shall cause all module input, output, and battery circuit breakers to open, completely isolating UPS from all sources of power. Critical load shall be automatically transferred to bypass without interruption when emergency shutdown is activated.

2.10 REMOTE MONITORING

1. Provide communication capabilities and access port on each of the UPS units to allow remote monitoring.
2. An Ethernet port shall be provided to remotely monitor the UPS utilizing Modbus TCP/IP. All alarm messages and standard measurements shall be available on the local port.
3. Provide four NO/NC form C dry contacts wired to terminal block accessible for landing field wiring to provide status signal for UPS in Bypass condition to external equipment.

2.11 BATTERY

1. UPS-1 and UPS-2 shall be backed up by two (2) battery strings designed to support two (2) 40 kVA/40 kW static UPS modules (one battery system per module).
2. Battery shall be sized to IEEE 485 to supply the full 40 kW rated output load of the UPS module for a minimum of 12 minutes at end of life using the following parameters:
    1. Battery cell end voltage of 1.67 volts per cell
    2. UPS inverter efficiency of 94%.
    3. Temperature Correction Factor to 22°C.
    4. Aging Factor of 1.00.
    5. Design Margin of 1.00.
3. Batteries shall be of the VRLA type, designed for an expected life of ten (10) years.
4. Batteries shall have sufficient kilowatt-hour capacity to supply the rated load for fifteen (12) minutes at 25°C (77*F), when reaching a minimum end cell voltage of 1.67 V at end of life. Any battery set failing to meet this requirement shall be replaced with an appropriately sized battery, and no cost (for shipping, installation labour or materials) shall be charged to the Owner.
5. The battery system shall be capable of sustaining 200 full-rated 12-minute discharges over its life.
6. Provide two (2) spare batteries of the same type as the batteries in the strings
7. Provide charger for the spare batteries. Characteristics of charger shall be adequate to keep the spare batteries in charged state at all times.

2.12 MANUFACTURERS

1. Vertiv (Liebert)
   Contact: Terry Schouten, 416-573-7517
2. Eaton (Powerware), as represented by Spectrum Power Systems
   Contact: A.J. Bajwa, 905-405-9791
3. Schneider
   Contact: Hitesh Mistry, 416-271-0544

3 Execution

3.1 UPS EQUIPMENT INSTALLATION

1. Locate UPS modules and batteries as shown on drawings, and bolt to concrete pads.
2. Make internal connections (power and control wiring) between the shipping splits as indicated in the manufacturer's installation drawings.
3. Connect input to each of the UPS modules and system bypass, and output from the modules to the UPS output panels.
4. Connect battery strings to their respective UPS modules.
5. Provide control, communications and monitoring conduit and wiring between UPS modules and batteries, and between the UPS modules and the facility's local area network (LAN), as per manufacturer's recommendations. Use information contained in the shop drawings for this purpose.
6. Run 2/0 AWG bare copper grounding conductor in 25mm (1") conduit from nearest ground bus to the ground lugs of the new UPS modules and battery cabinets.
7. Provide a rubber ground mat (full length) in front of each UPS equipment lineup.
8. Assist UPS Supplier's representative to verify that the entire UPS and battery installation and wiring is in accordance with the manufacturer's recommendations.
9. Do not conduct insulation resistance tests on the cables connected to the UPS, including HiPot and BIL tests, as the UPS electronic components are susceptible to damage.

3.2 UPS PRE-TESTING INSPECTION

1. Check factory made connections for mechanical security and electrical continuity.
2. Confirm phase rotation on AC power supply and load feeders.
3. Check mechanical alignment of breakers and switches. Operate moving components.
4. Verify fuse, breaker, and instrument settings.
5. Set and calibrate relays and trips. Exercise relays and breakers trip mechanism.
6. Ensure paint finishes are unblemished and uniform.
7. Check ground bus connections.
8. Inspect barriers, bus insulators, bushings, etc. Vacuum, wipe, clean interior and exterior to remove any accumulated dust or dirt.

3.3 TESTING AND COMMISSIONING

1. UPS testing and commissioning, including operator training shall be carried out by the equipment manufacturer. Coordinate with and provide support to the manufacturer for all services required during installation and site acceptance.
2. Provide adjustable load bank of capacity suitable for the capacity of the modules tested. Provide load bank cables of length suitable for the relative locations of the UPS modules and load bank. Allow for minimum 4-hour testing of each UPS module.

3. Test complete system including rectifiers, inverters, bypass switches, controls, and battery, in presence of Owner. Notify Owner one week in advance of date of site test that system has met the manufacturer's installation requirements and is ready for testing.

4. Test system with Utility power and Generator power. Take readings of fuel volume in generator fuel tank at the beginning and end of test. Top up fuel in the tank (and pay for the cost of the added fuel) to make up for the fuel consumption for testing.

5. Test procedures:

    1. Prepare blank forms and check sheet with spaces for recording data.

    2. Mark check sheet and record test data on forms in duplicate as test proceeds. Attach display readings.

    3. Provide Owner's signature on form to indicate concurrence in results reported.

    4. Completed forms (originals) to be included as part of O&M Manual.

6. Test equipment:

    1. Three phase, multi-channel power monitor with waveform capture, graphic display, and data logging capabilities (e.g. Dranetz, Fluke or equal).

    2. Instruments used during test to have recent calibration certificate.

7. Demonstrate the following:

    1. System start-up and shut down.

    2. Operation in each of the following modes:

        1. UPS modules online and supporting their load, AC power supply
        2. UPS modules supporting their load, on battery
        3. System in Bypass
        4. Any other manufacturer standard operation scenario

8. Prepare and submit Report with printed graphs showing waveforms of the input and output voltage and current to demonstrate seamless operation of each module on loss of mains power, transfer to static bypass and re-transfer from static bypass to inverter.

9. The above scenarios must be tested under mains power failure, recording output during failure, and return of mains power. Repeat several times.

    1. Functionality of protective devices and indications - for each of the UPS modules. Record actual settings and note operation of remote indications on transfer to bypass. Tests to include:

        1. Annunciator lights correct indication
        2. Overcurrent on inverter output
        3. Overvoltage and undervoltage of inverter output
        4. DC input voltage to inverter too low. Gradually reduce DC input voltage to inverter while delivering full load output; observe load transferring automatically to bypass and inverter shut down. Record input and output values.
        5. Simulate over temperature by applying heat to sensor with hot air blower.
        6. Simulate fuse blowing to test indication response.

7. Simulate fan failure.
8. Bypass switch automatic operations. Record with power monitor absence of load disturbance during automatic bypass switching.
9. Overvoltage of rectifier DC output.

2. Harmonic test:
   1. With system fully loaded, 50% loaded, and at no load, determine total harmonic content with harmonic distortion meter (or power monitor) at output terminals.
   2. Determine each harmonic magnitude with harmonic wave analyzer.
   3. Measure phase to neutral (downstream of transformers) at 0.8 lagging power factor.
3. Transients:
   1. With normal power input, apply full load to system.
   2. Remove one half load.
   3. Reapply one half load instantly.
   4. Record voltages and currents from each phase using power monitor for each of the above tests.
4. Steady load:
   1. Switch system onto AC mains, start inverter and connect load bank.
   2. Operate each UPS system at full rated load in each mode: load sharing, for 2 hrs; one module, for 2 hrs each, and at 125% load for 10 min, each module.
   3. Record data at start of test and at half hour intervals thereafter; including:
      1. Input frequency
      2. Input voltage, each phase.
      3. Input current, each phase
      4. Input kW.
      5. Output voltage, phase-to-phase, phase-to-neutral
      6. Output current, each phase
      7. Output kW.
      8. Temperature of ventilating air-in.
      9. Temperature of ventilating air-out.
      10. Temperature at critical zones.
      11. dc voltage to inverter
      12. dc current to inverter
      13. Rectifier dc current.
5. Varying loads:
   1. Take one set of readings at no load, 25% load, 50% load, 75% load and 125% load.
   2. Calculate efficiencies of rectifier, inverter, and complete system.
6. Unbalanced loads:
   1. Adjust loads on system to full load on two phases, 80% load on third phase.

2. Adjust loads on system to zero load on two phases, 20% load on third phase.
3. For both cases, record phase and line voltages and currents with phase angles to prove that phase relation remains unchanged with unbalanced loads.

7. Operating sound level:
    1. Measure sound level according to ANSI S1.13-1971 using sound level meter with a weighting and slow response, conforming to ANSI S1.4-1971.
    2. Operator to take reading by placing meter with microphone pointed at right angles to path of travel of generated sound, positioned at height of 1.5 m and distance of 1 m from equipment to be tested.
    3. Measure sound level during low ambient sound level.

3.4 OPERATOR TRAINING

1. Provide, with Supplier's support, the following hours of instruction to Owner personnel at the job site:
    1. Two (2) hours of instruction and training, prior to acceptance of system.
    2. An additional two 2-hour sessions, on dates scheduled with Owner.
2. Coordinate with the Owner the times for giving instruction. Provide both 'in-classroom' and hands-on training.
3. Prepare and submit an outline of the training material for review and approval by Owner. Record two copies of the instruction procedures on electronic media which shall be labelled and protected from erasure. The material shall be stored in a searchable PDF format.
4. Perform video recording of the training sessions for training future employees. Turn over the recorded media to the City.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

.1 This specification covers the supply and installation of one (1) automatic transfer switch, labelled ATS-3DP on the Single Line Diagram and layout drawings.

.2 The Contractor shall also provide the services of a factory-trained technician to support the installation Contractor during the installation of the transfer switch, if required, and to perform testing and commissioning at the site, after the equipment has been installed. The quoted price shall also include cost to conduct "hands-on" training at the installation site.

1.2 STANDARDS

.1 The automatic transfer switch shall bear the CSA or cUL certification marks.

.2 The automatic transfer switch and all associated components shall be manufactured in accordance with the following applicable standards:

.1 UL 1008 - Standard for Transfer Switch Equipment

.2 IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

.3 IEC 60947-6-1 Low-voltage Switchgear and Control Gear; Multifunction equipment; Automatic Transfer Switching Equipment

.4 NFPA 110 - Emergency and Standby Power Systems

.5 NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches

.6 UL 508 Industrial Control Equipment

1.3 SUBMITTALS

.1 Comply with submission requirements outlined in sub-section 5 of Section 26 05 00 – Electrical General Requirements.

.2 Shop drawings:

.1 weight and dimensions of all units.

.2 detailed description of transfer switch and its components

.3 layout drawings, including layouts of all control, metering and alarm devices, with terminal locations for power and control cabling

.4 one-line diagram and electrical ratings

,5 listing of all features, settings, metering and alarm devices, communications interface

.3 Operation and Maintenance Data:

1. Service Manual for the equipment proposed.
2. "as-built" drawings produced for this equipment, including such items as component arrangement, wiring and schematic diagrams.

3. step-by-step instructions for operating and maintenance applicable to transfer switch mechanism, controls, meters, alarms, indicators, and all other components.
4. illustrations, schedules, identification of equipment, terminals, wiring connections
5. safety precautions
6. maintenance and adjustment procedures.
7. recommended spare parts list, location of nearest parts' depot stocking suitable parts, and time required to deliver these to site.
8. certified copy of factory test results
9. fault locating guide.

1.4 SOURCE QUALITY CONTROL

.1 Comply with the general requirements of sub-section 7 of Section 26 05 00 – General Electrical Requirements.

.2 Perform inspection and functional tests to determine that switch, status lights, alarms, displays and all other operational characteristics of the system function as specified.

.3 Test equipment for operation from both AC power sources.

1.5 WARRANTY

.1 The automatic transfer switch shall be guaranteed against defective parts and/or workmanship for a period of one (1) year from the date of final acceptance. The warranty shall include all costs for material and labour.

.2 The manufacturer shall correct any deficiencies in the equipment which occur during the warranty period at no additional cost to the Owner. The manufacturer's technical representative must be available on site to repair the system on a priority basis, i.e., within 8 hours of being notified of a deficiency.

PART 2 - PRODUCTS

2.1 TRANSFER SWITCH

.1 The transfer switch in this application will be used to transfer between two sources of power, referred to as the "preferred source" and the "alternate source"; in most situations both sources will be either the utility power or the standby power.

.2 The transfer switch shall be automatic (break-before-make) type, with transfer accomplished with an adjustable interruption period in both directions.

.3 The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a solenoid mechanism, momentarily energized. The unit shall include both electrical and mechanical interlocks to prevent both sets of main contacts from being closed at the same time.

.4 The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.

.5 All main contacts shall be silver composition. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.

.6 Designs utilizing moulded-case circuit breakers or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.

.7 All terminal lugs, fittings and cabinet interconnections shall be provided. All wiring and colour coding shall conform to requirements of the Canadian Electrical Code. Wiring harnesses shall be bound with tie-wrap and strain relief provided where necessary. All wiring shall be colour-coded and identified with permanent markers at both ends. Wiring shall be protected in a manner which separates power and control wiring. Lugs shall be suitable for copper conductors, of number and size corresponding to the feeders shown in the attached Single Line Diagram.

2.2 RATINGS

.1 Electrical ratings of the transfer switches shall be as follows: 600 V, 60A, 3-pole, 22 kA withstand.

.2 Per IEEE 10008, 7th Edition, each transfer switch shall be capable of withstanding minimum fault current of 20 times its rating for one (1) second when protected by upstream circuit breakers wit adjustable settings.

2.3 ENCLOSURE

.1. The transfer switch shall be mounted in Type 1 enclosure, sprinkler-proof.

.2 Door-mounted controls shall be industrial grade type or equivalent; controls shall be provided on a separate removable plate.

.3 A mimic diagram shall be provided on the enclosure.

2.4 CONTROLLER

.1 The controller shall be a module specially designed for transfer switch operations.

.2 The controller's sensing and logic shall be provided by a built-in microprocessor; this shall also provide the ability to communicate serially through a serial communication module. Provide MODBUS or SNMP interface for communication with the power monitoring system.

.3 All field connections shall be wired to a common terminal block.

.4 The operator interface shall include an LCD display and keypad, integral to the controller module. Operational parameters shall also be available for viewing and limited control through the serial communications input port. The following parameters shall only be adjustable locally:

.1 Nominal line voltage and frequency

.2 Three phase sensing

.3 Operating parameter protection

.4 Transfer operating mode: Open transition

.5 All instructions and controller settings shall be easily accessible through the display and accomplished without the use of codes, calculations, or instruction manuals.

2.5 VOLTAGE AND FREQUENCY SENSING

.1 Voltage sensing shall be true RMS type and shall be accurate to ± 1% of nominal voltage. Frequency sensing shall be accurate to ± 0.2%.

.2 Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.

.3 Voltage and frequency on both the preferred and alternate sources (as noted below) shall be continuously monitored, with the following pickup, dropout setting capabilities (values shown as % of nominal):

Undervoltage: 70-98% drop-out; 85-100% pick-up
Overvoltage: 102-115% drop-out; 2% below trip pick-up
Underfrequency: 85-98% drop-out; 90-100% pick-up
Over frequency: 102-110% drop-out; 2% below trip – pick-up
Voltage Unbalance: 5-20% drop-out; 1% below drop-out – pick-up

.4 The controller shall be capable of sensing the phase rotation of both sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or CBA).

.5 Digital readout of voltage on all three phases, frequency and phase rotation of both sources shall be provided on the LCD display.

2.6 TIME DELAYS

.1 Adjustable time delays shall be provided to override momentary preferred and alternate source outages and delay all transfer signals.

.2 Two independently adjustable time delay modes shall be provided for re-transfer to the preferred source: one time delay shall be for normal re-transfer on power restoration, and the other for the Test mode. Time delay shall be automatically bypassed if the alternate source fails, and the preferred source is acceptable.

.3 The controller shall also provide 0-to-5-minute time delay for delayed transition operation.

2.7 OTHER FEATURES

.1 Three-position momentary-type test switch for Test **/** Auto / Reset modes. The Test position will simulate a preferred source failure. The Reset position shall bypass the time delays on either transfer to the alternate or retransfer to preferred source.

.2 Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the switch is connected to the preferred source and one contact closed, when the switch is connected to the alternate source.

.3 LED indicating lights shall be provided; one (green) for the switch supplied from the preferred source and (red) for the switch supplied from the alternate source.

.4 LED indicating lights shall provided to indicate source availability as determined by the voltage sensing trip and reset settings for each source.

.5 Ability to function in non-automatic mode if so desired.

PART 3 – EXECUTION

3.1 INSTALLATION

.1 Install transfer switch at the locations indicated on the drawings.

.2 Connect transfer switch to both sources of supply and to the load served.

.3 Connect power monitoring wiring to the electric power monitoring system.

.4 Provide equipment identification by means of nameplates. Indicate preferred and alternate sources of power and load served.

3.2 TESTING AND COMMISSIONING (SITE ACCEPTANCE TESTING)

.1 Perform testing and commissioning, including operator training, in collaboration with the supplier.

.2 Include energization and operation, including transfer operations.

.3 Demonstrate the following:

.1 Automatic transfer from the preferred to the alternate source and vice-versa

.2 Manual transfer between sources

.3 Perform initial calibration of protection devices and instrumentation at substantial completion of the installation.

3.2 TRAINING

.1 Provide training on the operational and maintenance aspects for the transfer switches in accordance with the training requirements outlined in Section 26 05 00 – General Requirements.

END OF SECTION

PART 1 - GENERAL

1.1 SCOPE

.1 This section describes the requirements for the new lighting system to be installed in the Server Room.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings for lighting equipment. Include the following information:

.1 method of mounting

.2 type of LED driver

.3 type of lamp, complete with watts, lumens, CRI, and colour temperature

.4 any other relevant features

1.3 SPARE LAMPS

.1 Provide spare lamps in a number of 10% of the total of lamps installed in each type of fixture.

PART 2 - PRODUCTS

2.1 LIGHT SOURCES

.1 For rapid and changing development of LED technology, provide most technically proven, advanced, and successfully tested LED technology at time of installation.

.2 LED and driver features to include:

.1 CSA approved, ULC listed and labeled.

.2 Luminaires for applications in climate-controlled area: operating temperature range through -20°C to 50°C.

.3 Specifications standards to meet requirements of IES LM 79 and LM-80

.4 Light Emitting Diodes (LED) features to include:

.1 LEDs to be selected from same colour bin size for consistency in chromaticity and meet ANSI C78 377A as a minimum.

.2 Generally, colour temperature range to be from 2700K to 6500K, specific temperature requirements are identified on schedule of luminaires.

.3 Minimum CRI of 80.

.4 Rated life (based on 70% lumen depreciation level) from 50,000 to 70,000 hours.

2.2 LED FIXTURE DRIVERS

.1 Driver (Ballast) features to include:

.1 Operate from 60 Hz input source of 120 VAC unless otherwise noted with sustained variations of ±10% (voltage and frequency) with no damage to driver.

.2 Output regulated to ±5% across load range

.3 Power factor greater than 0.9.

.4 Total harmonic distortion less than 20%

.5 Class A sound rating.

.2 Comply with ANSI C62.41 category A for transient protection.

2.3 FIXTURES

.1 As indicated in the fixture legend on the drawings.

.2 Acceptable manufacturer as per luminaire schedule or approved equal.

2.4 EXIT SIGNS

.1 Housing: cold rolled steel minimum 1.0 mm thick.

.2 Face and back plates: die formed cold rolled steel.

.3 LED lamps.

.4 Designed for minimum 100,000 h of continuous operation.

.5 Green and white “Running Man Logo”.

.6 Downlight: translucent acrylic in bottom of unit.

2.5 EMERGENCY BATTERY UNITS

.1 Electrical Characteristics: 120 V, ac supply, 24 V dc output, 60 min operating time

.2 Battery: sealed, maintenance free.

.3 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.

.4 Solid state transfer circuit.

.5 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.6 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.7 Lamp heads: integral on unit, 345° horizontal and 180° vertical adjustment. Lamp type: tungsten, 12 W.

.8 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit, white finish. Removable or hinged front panel for easy access to batteries.

.9 Auxiliary devices:

.1 Test switch.

.2 Time delay relay.

.3 Battery disconnect device.

.4 Cord and single twist-lock plug connection for ac.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate and install luminaires as indicated. Support independently of electrical raceways and mechanical pipes.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.2 CIRCUITING AND CONTROL

.1 Connect emergency lighting fixtures (battery packs) to twist-lock receptacles mounted high-up on the wall, at fixture level.

.2 Connect exit lights to emergency battery units.

.3 Connect general lighting to assigned circuits and switches.

END OF SECTION

DIVISION 27
COMMUNICATIONS SPECIFICATIONS

PART1 - GENERAL

1.1 WORK INCLUDED

1. Conform to the requirements of Divisions 0 and 1 and additional general information, which apply to and form part of all sections of the work.
2. Read and comply with all sections of this document.
3. These instructions apply to and form part of all Communications/Security and Electronic Safety and Security Systems Sections and drawing(s).
4. This specification is divided into Sections which are not intended to identify contractual limits between Sub-Contractors nor between the Contractor and his Sub-Contractors. The requirements of any one Section apply to all Sections. Refer to other Divisions and Sections to ensure a complete and operational system.
5. All drawings and details have been prepared to illustrate the existing and new conditions of the project and shall be considered diagrammatic. The Communications/Security Contractor shall ensure all components required to complete the fully operational system are installed with no additional cost to the Owner or the Technology Systems Consultant.
6. Provide all labour, materials, tools, and equipment required for the complete installation of work called for in all Sections of the Contract Documents.
7. The Communications/Security Contractor shall verify exact locations of all items shown and shall verify with the Technology Systems Consultant all new locations prior to installation. It shall be the responsibility of the Communications/Security Contractor to provide the Technology Systems Consultant detailed layouts of all rooms and locations of installation prior to installation for approval. All costs, including other trades as applicable, associated with changes resulting from non-approved installation will be the responsibility of the Communications/Security Contractor.
8. Minor changes in locations may be required by the Technology Systems Consultant to coordinate site conditions with other divisions and the Technology Systems Consultant reserves the right to make these changes with no additional cost to the Owner.

1.2 SCHEDULE

1. The Communications/Security Contractor shall be responsible to meet the project schedule as provided by the Project Manager and the Owner.
2. Work shall generally be performed during regular work hours unless noted otherwise in this document. The Communications/Security Contractor shall include for all necessary overtime labour to complete the project.
3. The Communications/Security Contractor shall supply a written project plan detailing schedule of installation in coordination with the overall project schedule. Project plan shall be prepared in MS Project.
4. At and near the completion of the project the Communications/Security Contractor will be responsible for providing project documentation for the Owner's further use. This shall include:

.1 Updated Excel Spreadsheet documenting the following:

a. Security Node Number
b. Cable ID
c. Location or door number

.2 Temporary As-Builts

.3 Contact Info for Cutover Technician

.4 As Built Test Results

.5 As-Built Drawings

.6 Verification Report

5. All documents and information shall be provided as further detailed in Section 27 00 11 and delivered to the Technology Systems Consultant.

1.3 LABOUR

1. The following Pre-Approved City of Toronto Contractors shall be the only contractors eligible to bid on the Communications scope of work:

Stream A - Vendor Name TOTAL VENDORS 64	RFS/VOR Contract Manager		RFS/VOR Contract Telephone	RFS/VOR Contract Manager eMail
Bell Canada	Tizzard	Lisa	416-605-1196	lisa.tizzard@bell.ca
Cantan Group 786 Inc	Somji	Imran	416-727-0407	imran@cantangroup.com
DesTech Consulting Services Inc.	Brown	Patrice Timothy	416-368-8455 XT. 255	pbrown@destech.com
Edgeworx Solutions Inc.	Hales	Colin	416-500-8202	colin.hales@edge-worx.com
FrontDesk Queue Management Systems	Jensen	Mads	647 928 3117	mhj@frontdesksuite.com
GHD Limited	Khanna	Bharat	+1 647 671-6603	bharat.khanna@ghd.com
iVedha Inc.	BALAN	Srini	416-970-5697	balan@ivedha.com
MNP LLP (Digitalembrace Inc.)	Fong	Henry	905-695-1313 X210	hfong@digitalembrace.comhenry.fong@mnp.ca
Procom Consultants Group Ltd.	Di Tiberio	Christina	416-995-7205	christinad@procom.ca
Shore Consulting Group Inc.	Siahou	Joseph	416-506-9998, ext. 221	rfs@shorecg.com
Slalom Consulting ULC	Raveendran	Musa	(647) 745-4725	musa.raveendran@slalom.com
SRA Staffing Solutions Ltd.	Hussein	Shemina	647-302-0258	shemina@srastaffing.com
ThoughtStorm Inc.	Pabla	Paul	416 662 5934	Paul.Pabla@thoughtstorm.ca
Titan Plus Software Inc.	Davydov	Alexandra	(647) 539-4888	adavydov@titanplussoftware.com
Youish Inc.	Derakhshani	Bud (Bahador)	4167025853	budd@youish.com

2. The following Pre-Approved City of Toronto Contractors shall be the only contractors eligible to bid on the Security scope of work:

Certified Dealer AC Technical Systems Limited 8 - 2100 FORBES ST WHITBY ON L1N 9T3	ATTN: Dominic Burns Email: dburns@actechnical.com (905) 666-8676
Bond Securcom 1 – 41 SCARSDALE RD TORNTO ON M3B 2R2	ATTN: Cesar Traverso Email: ctraverso@bondsecur.com (416) 256-6666
Chubb Security Systems 5201 EXPLORER DR MISSISSAUGA ON L4W 4H1	ATTN: Chris Middleton Email: chris.middleton@chubbfs.ca (905) 629-2600
Convergint Technologies 5716 COOPERS AVE MISSISSAUGA ON L4Z 2E8	ATTN: Eric Heagle Email: eric.heagle@convergint.com (905) 602-8622
Delco Security	ATTN: Mark Peterson Email: mpeterson@delcosecurity.com (416) 346-8628
Fitch Security Integration Inc. 14 METEOR DR TORONTO ON M9W 1A4	ATTN: Ed Fitchett Email: efitchett@fitch.ca (416) 235-1818
Certified Dealer Johnson Controls L.P. 56 LEEK CRESCENT RICHMOND HILL ON L4B 1H1	ATTN: Keith Porter Email: keith.porter@jci.com (647) 637-8010
Certified Dealer Met-Scan Canada Ltd. 104 – 30 KERN RD TORONTO ON M3B 1T1	ATTN: Rick Holder Email: rholder@met-scan.com (416) 391-2200 x111 (416) 709-3102
Paladin Technologies 4 – 2210 MARKHAM RD TORONTO ON M1B 5V6	ATTN: Marc Kingsbury Email: mkingsbury@paladinsecurity.com (416) 916-6767
Profile Security 110 – 5525 EGLINTON AVE W TORONTO ON M9C 5K5	ATTN: Jason Caissie Email: jasonc@profileinc.com (416) 695-1260 x235
Quinn Digital Asset Protection 3 – 7065 TRANMERE DR MISSISSAUGA ON L5S 1M2	ATTN: Rob Quinn Email: rob.quinn@quinndigital.ca (416) 441-3770 x223 (416) 303-6252
Siemens Building Technologies, Ltd. 1577 NORTH SERVICE RD OAKVILLE ON L6H 0H6	ATTN: Manny Lopes Email: manuel.lopes@siemens.com (905) 799-9937

Securitas ES Canada 100 – 15 MARMAC DR TORONTO ON M9W 1E7	ATTN: Joe Finn Email: joel.finn@securitases.com (647) 616-3183
Stanley Convergent Security Solutions 1 – 2495 MEADOWPINE BLVD MISSISSAUGA ON L5N 6C3	ATNN: Scott Jupp Email: scott.jupp@sbdinc.com (289) 290-7100
Veridin Systems Canada Inc. 13 – 245 MATHESON BLVD E MISSISSAUGA ON L4Z 3C9	ATTN: Mike Finelli Email: mfinelli@veridin.ca (905) 568-9100
Vipond Inc. 6380 VIPOND DR MISSISSAUGA ON L5T 1A1	ATTN: Mark Gill Email: mark.gill@vipond.ca (905) 564-7060 x297 (647) 527-6339

3. The Pre-Approved Communications / Security Contractor shall provide only skilled, trained tradesmen experienced in the installation of a certified installation. Each installer shall be certified with the manufacturer providing the warranty for this project. All installers shall have successfully completed the approved manufacturer's installation training program.

4. The Pre-Approved Communications / Security Contractor shall possess a valid insurance certificate to be eligible for contract award. The General Contractor shall confirm and validate insurance certificate eligibility to the City of Toronto before awarding contract to contractor.

5. The Technology Systems Consultant reserves the right to request written proof of such training at any time during the project. If such proof is not provided, the Communications/Security Contractor will remove the installer from the site immediately and replace them with a trained installer within 24 hours.

6. The Pre-Approved Communications / Security Contractor shall be responsible to provide Union or Non-union labour as required on the project site and meet all requirements without any delay or cost to the Owner, General Contractor, or other trades.

7. Sub-Contractors shall not be allowed to perform all or any portion of the project unless approved in writing by the Technology Systems Consultant and the Owner. Subcontractors shall be identified at time of tender to be considered for approval.

8. The Pre-Approved Communications / Security Contractor shall always be in compliance with local, provincial and federal employee standards, safety acts, fire codes and other applicable legislation, codes and acts affecting the delivery of the project. The Communications/Security Contractor is responsible for the training and notifying their employees of any details associated with all codes, standards, acts, and legislation applicable to this project.

9. WSIB (Workplace Safety Insurance Board) clearance certificate indicating a good standing shall be provided by the Communications/Security Contractor prior to acceptance of any contract.

10. Provide personal identification in a form acceptable to the Owner for all employees attending the site for this project when requested.

1.4 DRAWINGS AND SPECIFICATIONS

1. It is the responsibility of the Communications/Security Contractor to carefully read these specifications and drawings and report any discrepancies immediately to the Technology Systems Consultant.
2. At the time of tendering the Communications/Security Contractor shall notify the Technology Systems Consultant in writing of any equipment, wiring feature, software, or device necessary for full operation of any of the systems which is not included in the specification documents or drawings. Failure to supply notification shall not relieve the Communications/Security Contractor of the responsibility for providing a fully functioning system at the bid price.
3. While every attempt has been made to ensure that all information (including specified products and part numbers) is correct, it is the responsibility of the Communications/Security Contractor to verify availability of products and verify all part numbers.
4. Specifications and drawings are schematic and represent the intent of the project.
5. Dimensions and measurements shown in these documents shall be verified by the Communications/Security Contractor on site prior to final installation.
6. Quantities and lengths identified are approximate and shall not be used to gauge or limit work.
7. These Specifications are an integral part of the accompanying drawings. Any item or subject omitted from one or the other, but which is either mentioned or implied shall be considered as properly and sufficiently specified.
8. Certain details indicated on the drawings are general in nature and are not specifically identified for each occurrence of use; however, such details shall be applicable to every occurrence on the drawings.
9. The location and size of existing services and equipment shown on the drawings are based on the best available information. The Communications/Security Contractor shall verify the exact location, type, size and any other pertinent information prior to commencing work.

1.5 INSTALLATION

1. Leave areas clear where space has been designated as reserved for future equipment and equipment for other trades.
2. Adequate space and provisions shall be left for removal of components and servicing of equipment, with minimum inconvenience to the operation of systems.
3. Where equipment is shown to be ‘roughed in only’ obtain information from the Technology Systems Consultant before proceeding with the work.

1.6 COORDINATION

1. The Communications/Security Contractor shall provide an installation and make all changes associated with coordination with other trades and to accommodate unforeseen site conditions at no additional cost to the Owner.
2. Prepare interference drawings and sketches for presentation to the Technology Systems Consultant to review any anticipated conflicts with other trades.

3. Prepare detailed layouts of equipment rooms prior to installation for review by the Technology Systems Consultant. Layouts shall indicate other major pieces of equipment being supplied by other trades.

4. The Communications/Security Contractor shall be responsible for attending coordination meetings as requested by the General Contractor or Project Manager for the coordination of locations and services. The project manager selected shall be assigned for the duration of the project and may only be changed with the written consent of the Technology Systems Consultant.

5. The Communications/Security Contractor in addition to coordination meetings shall attend weekly site meetings and be prepared to provide current project progress status, anticipated completion of future tasks and information on outstanding delivery items.

6. Access to the site shall be in compliance to all rules, regulations, safety standards and security procedures established for the project or building. Fees for after-hours access shall be considered included in the tender amount. No additional cost shall be accepted by the Owner for these requirements.

7. Access to the site shall comply to all rules, regulations, safety standards and security procedures established for the project or building. Fees for afterhours access shall be considered included in the tender amount. No additional cost shall be accepted by the Owner for these requirements.

8. Cutting and patching of all surfaces as applicable to the Communications/Security installation shall be the responsibility of and be performed by the Communications/Security Contractor. All work shall be performed to the standards set by codes and standards, Building Management, General Contractor and the Owner.

9. Cutting and patching of all structural members shall be approved by the Structural Consultant prior to work starting.

10. Work causing noise, dust and/or odour shall be performed during evenings and/or weekends to prevent disturbance to the operation of the Owner's or surrounding businesses. Work shall be performed at agreed times and in coordination with each party. All damages caused for work performed not in compliance with this item shall be the responsibility of the Communications/Security Contractor.

1.7 TEMPORARY SERVICES

1. The Communications/Security Contractor shall provide all required materials, labour, tools, and equipment to meet the temporary requirements of the project in coordination with other trades and the General Communications/Security Contractor at no additional cost to the Owner.

2. All hoisting, mechanical lifts and special scaffolds shall be the responsibility of the Communications/Security Contractor and at no additional cost to the Owner.

3. All power supplies, extension cords and equipment cords shall be the responsibility of the Communications/Security Contractor and shall be installed in good working order and in accordance with all codes, standards and building regulations.

1.8 COPERATION WITH OTHER DVISIONS

1. Communications/Security cabling shall not touch or be supported from piping, ductwork, conduits, ceiling supports or any other service / equipment. Communications/Security

cabling shall be supported by approved J-hooks, cable slings, ladder / basket tray and/or conduit as outlined in this document.

2. Supply all items to be built in ample time for rapid progression of the work. Schedule and provide manpower and materials to proceed with work as required to satisfy the construction schedule.

1.9 EXISTING SERVICES AND EQUIPMENT

1. All changes and connections to existing services shall be made only in a manner and at a time approved by the Technology Systems Consultant and/or the Owner so as to avoid any interruption of such services during normal working hours. If necessary, changes and connections to existing services shall be made outside of normal business hours at no extra cost to the Owner.

1.10 METRIC CONVERSIONS

1. Particular attention shall be paid to Imperial versus S.I. Metric conversions. This applies to all services including, but not limited to, equipment, material, and site services in both new and existing installations.
2. Conform to Canadian Metric Practice Guide CSA-CAN3-2234-1-89.

PART 2 - PRODUCTS

2.1 GENERAL

1. All equipment and products supplied shall be new and free of all manufacturer defects and delivery or installation damage.
2. All equipment and products supplied shall meet all manufacturer listed characteristics as identified in the latest manufacturer catalogue.
3. All products shall meet all applicable codes and standards and bare the UL/ULC label, be CSA approved and meet FCC/CRTC Regulations.
4. All products shall be provided in accordance with local, provincial, and national fire ratings for the installation on this project.
5. The only acceptable Manufacturers for this project and as further specified in this document will be the following:

Bosch	Access Control
Hartmann	Access Control
HID	Access Control
LenelS2	Access Control

2.2 SUBSTITUTIONS

1. Substitution of any product shall be prior approved in writing by only the Technology Systems Consultant.
2. The procedure for substitution approval will include the written submission by the Communications/Security Contractor including the following:

   .1 Original specified product

.2 Proposed product being substituted

.3 Reason for substitution

.4 Shop drawings indicating all technical specifications

.5 Financial advantage

.6 Schedule delivery date

.7 Written approval from certifying system manufacturer

3. Based on the review of the information requested above, the Owner and/or Technology Systems Consultant reserve the right to reject any proposed substitution without delay or cost to the project or the Owner.

2.3 MATERIAL HANDLING

1. The Communications/Security Contractor is responsible for the delivery of all materials to site and transportation to the workplace in accordance with all safety regulations and procedures.
2. Plan and schedule all hoisting with Building Management and the General Contractor.
3. Provide and be responsible for lockable storage for all tools and material required to complete the installation through the duration of the project. Once the project is complete, remove all tools and excess materials within 2 business days.
4. The Owner and its representatives shall in no way be held liable for any missing material, equipment or tools required to complete the installation.

PART 3 - EXECUTION

3.1 GENERAL

1. The Communications/Security Contractor shall supply all materials, labour, tools and equipment to provide a complete warranted installation as outlined in the contract documents and suitable to the approval of the Owner, the Technology Systems Consultant and inspection bodies having jurisdiction.
2. Provide continuity of all existing services while completing the specified installation. Losses due to interruption of services will be the responsibility of the Communications/Security Contractor.
3. Arrange for all shutdowns (1) week prior in writing with the Project Manager and those in control of services shall be disrupted. All overtime costs, fees, security, and other requirements shall be the full responsibility of the Communications/Security Contractor.
4. Should services be interrupted accidentally, the Communications/Security Contractor shall provide material and labour to re-establish services immediately and shall continue without stoppage until all services have been restored. All material and labour costs including overtime shall be borne solely by the Communications/Security Contractor. Any material and/or labour costs including overtime associated with other trades and/or the General Contractor to assist in any way the Communications/Security Contractor in re-establishing services shall be borne solely by the Communications/Security Contractor.

3.2 SITE CONDITIONS

1. The Communications/Security Contractor is responsible for maintaining a clean work environment and is responsible for the removal of all debris daily. Debris and removed materials shall be disposed of in conformance with all local by laws and regulations. Failing to comply and after reasonable time and written notice the General Contractor reserves the right to hire cleaners to complete the cleaning and back charge the Communications/Security Contractor.

2. The Communications/Security Contractor shall be responsible for the removal and reinstallation of all floor or ceiling tiles, hatch ways or access panels. All items shall be removed and replaced daily and left in the original condition. Special caution shall be taken to not break, chip or discolour with dirt or fingerprints any such items. The Communications/Security Contractor will be fully responsible for repair or replacement of all damaged pieces at the discretion of the Project Manager or Owner.

3. The Communications/Security Contractor is fully responsible for storage of all temporarily removed items for the project.

4. All materials and installation throughout the project will remain the responsibility of the Communications/Security Contractor until final completion for the project is accepted by the Owner. Damages to any item installed shall be replaced or repaired by the Communications/Security Contractor to provide a complete final installation at no additional cost to the Owner.

5. At the completion of the project or as and when the Owner requires, restore the original condition of all materials, equipment and surfaces within the wok area affected by this installation.

6. All vehicular traffic entering the site shall be coordinated with the General Contractor and no parking or compensation for paid parking will be provided by the Owner.

3.3 CUTTING, PATCHING AND REPAIRING

1. It is the responsibility of the Communications/Security Contractor to perform all cutting, patching and repair related to their work including any penetrations through walls or floors.

3.4 HOISTING FACILITIES

1. This Division shall provide its own hoisting facilities regardless of height required to perform work.

2. Hoisting facilities may be provided by the General Contractor, although the General Contractor may at its own discretion not allow the Communications/Security Contractor to make use of such.

3.5 SAFETY

1. The Communications/Security Contractor shall adhere to all safety laws, rules and regulations issued by the authorities having jurisdiction, General Contractor, Project Manager, and the Owner.

2. The Communications/Security Contractor shall attend all Safety Program meetings requested by the General Contractor.

3. Provide adequate protection in work areas to occupants of the building and other trade traffic using approved safety barriers, caution tape and signage.

4. At all times maintain clear fire exits, exit paths and access to emergency equipment including fire hose cabinets, fire extinguishers and stand pipe connections.
5. Smoking and combustion of any materials is strictly prohibited on all sites.
6. Provide information to all employees of emergency and fire safety plans for the work site and facility.
7. Provide protection as required by the authorities having jurisdiction to all employees for work performed in typically inaccessible or concealed spaces.
8. If an approved subcontractor is used provide information and ensure all safety specifications herein are meet.

3.6 SITE ADJUSTMENTS

1. Locations or all equipment, outlets or devices prior to installation may be revised to within (3) meters without any additional cost or change request.
2. Portions of the project may be at any time identified in writing to be “On Hold”. Work in these areas shall not be started, continued, or completed until further direction is received. No additional cost shall be accepted by the Owner for areas put on hold.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1. The following definitions may be used in this document, as well as in any project documents such as but not limited to Addenda, Contemplated Change Notices, Change Orders, and Site Instructions:

Addendum	-	Normative document used to provide additional requirements and recommendations to a published document (e.g., standards, contracts). When published, an addendum effectively becomes part of the document that it supports.
Bonding	-	The permanent joining of metallic parts to form an electrically conductive path that will ensure electrical continuity and the capacity to conduct safely any current likely to be imposed.
Bonding Conductor (BC)	-	A conductor used specifically for the purpose of bonding.
Building Entrance Facility	-	The room or space inside a building where telecommunications cables enter and leave the building.
Communications Contractor	-	The successful bidder(s) to this Specification responsible for the supply and installation.
Category	-	A rating that defines the performance of cabling components and systems. Describes mechanical properties and transmission characteristics of balanced twisted-pair cabling and provides a numbered designation.
Change Notice	-	Normative document approved to provide additional requirements and recommendations that describes and authorizes the implementation of an engineering change to the product and its approved configuration documentation.
Owner	-	City of Toronto
Technology Systems Consultant	-	Gregory Larcina SPECTECH
Contemplated Change Notice	-	Normative document to provide additional requirements and recommendations that describes the implementation of an engineering change to the product and its approved configuration documentation for the purposes of pricing. This document does not authorize the implementation of a change to the product and its approved configuration documentation.

Cut Over	-	The live date(s) when the Owner will occupy the space as indicated by date and/or phasing.
Grounded Conductor	-	A system or circuit conductor that is intentionally grounded.
Grounding System	-	A system of hardware and wiring that provides an electrical path from a specified location to an earth ground point.
Modular Copper Patch Panel	-	A patch panel that allows each RJ-45 outlet (or port) to be removed individually.
Project	-	Supply and installation of a complete Structured Cabling Solution to support Voice, Data and/or Video applications as described in this document.
Provide	-	Supply and install.
Workstation	-	Systems Furniture Workstation, Office, Meeting Room, Boardroom, Classroom, etc. Any Voice or Data cable originating in a Telecom, LAN, Computer Room or Consolidation Point that is not terminated on a patch panel / IDC Block at the other end.

2. The following abbreviations may be used in this document:

A	-	Ampere
ac	-	Alternating current
ACR	-	Attenuation to Cross-Talk Ratio
ADC	-	Analog to Digital Converter
ADSL	-	Asymmetric Digital Subscriber Line
A/E	-	Architect or Engineer
AFF	-	Above Finished Floor
AHJ	-	Authority Having Jurisdiction
ALPETH	-	Aluminum Polyethylene
AME	-	Architectural, Mechanical, Electrical
AN	-	Access Node
ANSI	-	American National Standards Institute
AP	-	Access Point
ARPAP	-	Resin-coated Aluminum, Polyethylene Aluminum, Polyethylene
ASCII	-	American Standard Code for Information Interchange
ASP	-	Aluminum Steel Polyethylene
ASTM	-	American Society for Testing and Materials
ATD	-	Asynchronous Time Division
ATDM	-	Asynchronous Time Division Multiplexing
ATM	-	Asynchronous Transfer Mode
Attn	-	Attenuation
AV	-	Audio-Video
AVS	-	Audio-Video System
AWG	-	American Wire Gauge

BAS	-	Building Automation System
BC	-	Bonding Conductor
BCD	-	Backbone Conduit
BCT	-	Bonding Conductor for Telecommunications
BEF	-	Building Entrance Facility
BER	-	Bit Error Rate
BERT	-	Bit Error Rate Test
BFOC	-	Bayonet Fibre Optic Connector
BIC	-	Building Industry Consultant
BICSI®	-	Building Industry Consulting Service International
bit	-	Binary Digit
BOM	-	Bill Of Material
b/s	-	Bit per Second
BWA	-	Broadband Wireless Access
CA	-	Cable
CACSP	-	Coated Aluminum Coated Steel Polyethylene
CAD	-	Computer Aided Design
CATV	-	Community Antenna Television (Cable Television)
CBN	-	Common Bonding Network
CCIA	-	Computer Communications Industry Association
CCN	-	Contemplated Change Notice
cct	-	Circuit
CCTV	-	Closed Circuit Television
CD	-	Compact Disc
CD	-	Change Directive (same as Change Notice and Change Order)
CEC	-	Canadian Electrical Code
CEF	-	Cable Entrance Facility
cm	-	Centimetre
CMP	-	Communications Plenum
CMR	-	Communications Riser
CN	-	Change Notice (same as Change Directive and Change Order)
CO	-	Change Order (same as Change Notice and Change Directive)
coax	-	Coaxial Cable
CO-OSP	-	Customer-Owned Outside Equipment
CP	-	Consolidation Point
CPU	-	Central Processing Unit
CPVC	-	Chlorinated Polyvinyl Chloride
CSA	-	Canadian Standards Institute
CSC	-	Construction Specifications Canada
CSI	-	Construction Specifications Institute
CT	-	Cable Tray
Cu	-	Copper
c/w	-	Complete With
dB	-	Decibel
dB/km	-	Decibel per Kilometre
dBm	-	Decibel milliwatt
dBmV	-	Decibel millivolt
demarc	-	Demarcation Point
D-ring	-	Distribution Ring
DSL	-	Digital Subscriber Line
EF	-	Entrance Facility
EIA	-	Electronics Industry Alliance
ELFEXT	-	Equal Level Far-End Crosstalk

e-mail	-	Electronic Mail
EMI	-	Electromagnetic Interference
EMI/RFI	-	Electromagnetic Interference / Radio Frequency Interference
ER	-	Equipment Room
ESD	-	Electrostatic Discharge
e/w	-	Equipped With
FC	-	Fibre Connector
FCC	-	Federal Communications Commission
FDDI	-	Fibre Distributed Data Interface
FEP	-	Fluorinated Ethylene Propylene
FEXT	-	Far-End Crosstalk
FOTP	-	Fibre Optic Test Procedure
ft	-	Foot / Feet
ft2	-	Square Foot / Feet
FTTD	-	Fibre To The Desk
FT 1 / FT 3	-	Fractional T 1 / Fractional T 3
G	-	Giga
Gb	-	Gigabit
GB	-	Gigabyte
Gb/s	-	Gigabit per Second
GC	-	General Contractor
GHz	-	Gigahertz
HC	-	Horizontal Cross-connect
Hz	-	Hertz
I	-	Current
IC	-	Intermediate Closet
IC	-	Intermediate Cross-connect
ID	-	Identification
ID	-	Inside Diameter
IDC	-	Insulation Displacement Connection
IDC	-	Insulation Displacement Connector
IDC	-	Insulation Displacement Contact
IDF	-	Intermediate Distribution Frame
IEEE®	-	Institute of Electrical and Electronics Engineers, Inc. ®
IG	-	Isolated Ground
in	-	Inch
in2	-	Square Inch
I/O	-	Input / Output (Device)
IOR	-	Index Of Refraction
ISDN	-	Integrated Services Digital Network
ISO	-	International Organization for Standardization
IT	-	Information Technology
kb	-	Kilobit
kB	-	Kilobyte
kg	-	Kilogram
km	-	Kilometre
kV	-	Kilovolt
kVA	-	Kilovoltampere
kW	-	Kilowatt
kWh	-	Kilowatt hour
LAN	-	Local Area Network
laser	-	Light Amplification by Stimulated Emission of Radiation
lb	-	Pound

LED	-	Light Emitting Diode
LO	-	Laser Optimized
LSZH	-	Low Smoke Zero Halogen
m	-	Metre
m2	-	Square Metre
mA	-	Milliampere
MAC	-	Move, Add, or Change
MAN	-	Metropolitan Area Network
Mb	-	Megabit
MB	-	Megabyte
Mb/s	-	Megabit per Second
MB/s	-	Megabyte per Second
MC	-	Main Cross-connect
MDF	-	Main Distribution Frame
MGB	-	Main Grounding Busbar
MHz	-	Megahertz
mi	-	Mile
MIMS	-	Mineral Insulated Metal Sheathed
min	-	Minute
mm	-	Millimetre
MM	-	Multimode
MMF	-	Multimode Fibre
Misc	-	Miscellaneous
MPP	-	Modular Patch Panel
ms	-	Millisecond
MSDS	-	Material Safety Data Sheet
MUTO	-	Multi-user Telecommunications Outlet
MUTOA	-	Multi-user Telecommunications Outlet Assembly
mW	-	Milliwatt
MW	-	Megawatt
NBCC	-	National Building Code of Canada
NESC	-	National Electrical Safety Code
NEXT	-	Near-end Crosstalk
NIC	-	Network Interface Card
NIR	-	Near-end crosstalk-to-Insertion loss Ratio
NRCC	-	National Research Council of Canada
OD	-	Outside Diameter
OEM	-	Original Equipment Manufacturer
OF	-	Optical Fibre
OSP	-	Outside Plant
PBX	-	Private Branch Exchange
PDU	-	Power Distribution Unit
PP	-	Patch Panel
PSACR	-	Power Sum Attenuation to Crosstalk Ratio
PSELFEXT	-	Power Sum Equal Level Far-End Crosstalk
PSNEXT	-	Power Sum Near-End Crosstalk
PVC	-	Polyvinyl Chloride
QA	-	Quality Assurance
QC	-	Quality Control
QoS	-	Quality of Service
Qty	-	Quantity
RCDD®	-	Registered Communications Distribution Designer
RF	-	Radio Frequency

RFI	-	Radio Frequency Interference
RJ	-	Registered Jack
rms	-	Root Mean Square
RU	-	Rack Unit (1.75")
RX	-	Receive
RX	-	Receiver
SAN	-	Storage Access Network
SC	-	Single Fibre Coupling Optical Fibre Connector
SCC	-	Standards Council of Canada
SCS	-	Structured Cabling Solution
ScTP	-	Screened Twisted Pair
SFTP	-	Screened Foiled Twisted Pair
SI	-	International System of Units (Le Système International d'Unités)
SLA	-	Service level Agreement
SM	-	Singlemode
SMF	-	Singlemode Fibre
SNMP	-	Simple Network Management Protocol
SNR	-	Signal-to-Noise Ratio
STALPETH	-	Steel Aluminum Polyethylene
STP	-	Shielded Twisted Pair
STP-A	-	Shielded Twisted Pair A
T 1	-	Trunk Level 1
TBB	-	Telecommunications Bonding Backbone
TBBIBC	-	Telecommunications Bonding Backbone Interconnecting Bonding Conductor
TC	-	Telecommunications Closet
TDD	-	Telecommunications Device for the Deaf
TGB	-	Telecommunications Grounding Busbar
TGR	-	Telecommunications Grounding Rod
TIA	-	Telecommunications Industry Association
TMGB	-	Telecommunications Main Grounding Busbar
TP	-	Twisted Pair
TR	-	Telecommunications Room
TS	-	Technical Standard
TSB	-	Telecommunications Systems Bulletin (formerly Technical Systems Bulletin)
TTY	-	Teletypewriter / Text Telephone
TV	-	Television
TX	-	Transmit
TX	-	Transmitter
U	-	(When preceded by a numeral) Rack Unit (equal to 1.75")
UD	-	Underfloor Duct
UL®	-	Underwriters Laboratories Inc.®
ULC	-	Underwriters Laboratories of Canada
UPC	-	Universal Product Code
UPS	-	Uninterruptible Power Supply
UTP	-	Unshielded Twisted Pair
V	-	Volt
VA	-	Volt-Ampere
VCS	-	Voice Communications System
VCSEL	-	Vertical Cavity Surface Emitting Laser
VLAN	-	Virtual Local Area Network
VoIP	-	Voice over Internet Protocol

VPN	-	Virtual Private Network
W	-	Watt
WAN	-	Wide Area Network
WAP	-	Wireless Application Protocol
Wi-Fi	-	Wireless Fidelity
Wi-Fi	-	Wireless Fidelity
WLAN	-	Wireless Local Area Network
WMAN	-	Wireless Metropolitan Area Network
WS	-	Workstation
WWAN	-	Wireless Wide Area Network
x	-	Mathematical Operation (Multiplication)
X	-	Cross-connect
XC	-	Cross-connect
XLPE	-	Cross-linked Polyethylene
XPE-PVC	-	Expanded Polyethylene Polyvinyl Chloride

Part 2 PRODUCT

2.1 Not applicable to this Section.

Part 3 EXECUTION

3.1 Not applicable to this Section.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1. Comply with Section 27 00 03 – General Requirements.

1.2 GENERAL

1. The Communications/Security Contractor shall adhere to all applicable codes, standards, and regulations.
2. All equipment, products and installation methods shall adhere to all Codes and Standards having jurisdiction and as listed in this document.
3. The latest version, including technical bulletins and addenda will be applicable to all codes and standards.
4. If a conflict between codes and standards occur the most stringent code or standard will be applicable.
5. Non-plenum (CMR) and plenum rated (CMP) cables shall be ULC (UL) Listed and/or SA Certified.
6. The following list highlights the typical applicable standards. All national and local codes and standards not listed for Products, Buildings, Fire, Health and Safety and Electrical will also apply.
7. All standards' addenda shall be included.

ANSI/TIA/EIA 568-B.1	-	Commercial Building Telecommunications Cabling Standard: General Requirements
ANSI/TIA/EIA 568-B.2	-	Commercial Building Telecommunications Cabling Standard: Balanced Twisted Pair Cabling
ANSI/TIA/EIA 568-B.3	-	Commercial Building Telecommunications Cabling Standard: Optical Fibre Cabling Components Standard
ANSI/TIA/EIA 569-A	-	Commercial Building Standards for Telecommunications Pathways and Spaces. Including Addenda 1-6
ANSI/TIA/EIA 598-A	-	Optical Fibre Cable Color Coding
ANSI/TIA/EIA 570	-	Residential and Light Commercial Telecommunications Wiring Standard
ANSI/TIA/EIA 604	-	Fibre Optic Connector Intermateability Standard (Focis3)
ANSI/TIA/EIA 606	-	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI/TIA/EIA 607	-	Commercial Building Grounding and Bonding Requirements for Telecommunications
ANSI/TIA/EIA 758	-	Customer Owned Outside Plant Telecommunications Cabling Standard
CSA C22.1-98:21	-	Canadian Electric Code Part I: Safety Standards for Electrical Installations
CSA C22.2 No. 0	-	Canadian Electric Code Part II: General Requirements (Communications Cables)
CSA C22.2 No. 181.4	-	Plugs, Receptacles, and Connectors for Communication Systems

CSA C22.2 No. 214	-	Communications Cables
CSA C22.2 No. 0	-	Canadian Electric Code Part II: General Requirements (Communications Cables)
CSA C22.2 232 M1998	-	Canadian Electric Code Part II: Optical Fibre Cables
CSA T527	-	Grounding and Bonding for Telecommunications in Commercial Buildings
CSA T528	-	Design Guidelines for Administration of Telecommunications Infrastructure in Commercial Buildings
CSA T529	-	Design Guidelines for Telecommunications Wiring Systems in Commercial Buildings
CSA T530	-	Building Facilities, Design Guidelines for Telecommunications
BICSI ITSIM	-	Information Transport System Installation Manual
CAN/ULC S115	-	Standard Method of Fire Tests of Fire stop Systems
CAN/ULC S101	-	Standard Method of Fire Endurance Tests of Building Construction and Materials
CAN/ULC S102	-	Standard Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies
J-STD-607	-	Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
TIA-942	-	Telecommunications Infrastructure Standards for Data Centers
CEC, Part 1	-	The Canadian Electrical Code, Part 1
OESC	-	Ontario Electrical Safety Code – 28th Edition/2021
O.R. 388/97	-	Ontario Fire Code
O.R. 332/12	-	Ontario Building Code 2021
IEEE 802.3	-	Information Technology – Telecommunications and Information Exchange Between Systems – Local and Metropolitan Area Networks p Specific Requirements Part 3 Carrier Sense Multiple Access with Collision
IEEE 802.11	-	Local and Metropolitan Area Networks – Specific Requirements Part 11: Wireless LAN Medium Access Control and Physical Specifications
ANSI/ICEA S-80-576	-	Communication Cables
ANSI/ICEA S-83-596	-	Fibre Optic Premises Distribution Cable
ANSI/ICEA S-83-640	-	Fibre Optic Outside Plant Communications Cable
ANSI/ICEA Z136.2	-	American Standards for the Safe Operation of Optical Fibre Communication Systems Utilizing Laser Diode and LED Sources
ANSI/TIA/EIA 455	-	Fibre Optic Test Procedures
ANSI/TIA/EIA 492AAAA	-	Detail Specification for 62.5-mm Core Diameter/125-mm Cladding Diameter Class Ia Multimode, Graded-Index Optical Waveguide Fibres
ANSI/TIA/EIA 492AAAB	-	Detail Specification for 50.0-mm Core Diameter/125-mm Cladding Diameter Class Ia Multimode, Graded-Index Optical Waveguide Fibres

ANSI/TIA/EIA 492BAAA	-	Detail Specification for Class IVa Dispersion-Unshifted Singlemode Optical Waveguide Fibres Used in Communications Systems
ANSI/TIA/EIA 472CAAA	-	Detail Specification for All-Dielectric (Construction 1) Fibre Optic Communications Cable for Indoor Plenum Use, Containing Class Ia, 62.5 mm Core Diameter/125 Cladding Diameter Optical Fibre(s)
ANSI/TIA/EIA 472DAAA	-	Detail Specification for All-Dielectric Fibre Optic Communications Cable for Outside Plant Use, Containing Class Ia, 62.5 mm Core Diameter/125 mm Cladding Diameter/250 mm Coating Diameter Optical Fibre(s)
ANSI INCITS 263	-	Information Technology – Fibre Distributed Data Interface (FDDI) – Token Ring Twisted Pair Physical Layer Medium Dependent (TP-PMD)
CENELEC EN 50173	-	Performance Requirements for Generic Cabling Schemes
FIPS PUB 174	-	Commercial Building Telecommunications Wiring Standard. Federal Information Publication Standard
ICEA S-90-661	-	Individually Unshielded Twisted Pair Indoor Cable for Use in Communications Wiring Systems
IEC 603-7, Part 7	-	Detailed Specifications for Connectors, 8-Way, Including Fixed and Free Connectors with Common Mating Schemes
ISO/IEC IS 11801A	-	Generic Cabling for Customer Premises
NEMA WC 63	-	Performance Standard for Field Testing of Unshielded Twisted-Pair Cabling System
UL 444 and 13	-	Adopted Test and Follow-Up Service Requirements for The Optional Qualification of 100Ω Twisted-Pair
UL 1492	-	Standard for Safety Audio-Video Products and Accessories
UL 983	-	Standard for Surveillance Camera Units
UL 1459	-	Standard for Telephone Equipment
UL 1950	-	Standard for Information Technology Equipment
UL 1076	-	Standard for Proprietary Burglar Alarm Units and Systems
ULC-S302	-	Standard for Installation and Classification of Burglar Alarm Systems for Financial and Commercial Premises, Safe and Vaults
ULC-S303	-	Standard for Local Burglar Alarm Units and Systems
ANSI/BICSI 005-2013	-	Electronic Safety and Security (ESS) System Design and Implementation Best Practices

PART 2 - PRODUCTS

2.1 Not applicable to this Section.

PART 3 - EXECUTION

3.1 COMPLIANCE TO CODES AND STANDARDS

1. The Communications/Security Contractor shall install all equipment and material in accordance with the standards afore mentioned in this section.
2. Quality and workmanship shall be at the highest of professional tradesman levels to be accepted for completion. The Technology Systems Consultant shall have the sole right to reject any work not in accordance with industry standards.
3. All work shall also be performed in accordance with the latest BICSI installation standards.
4. Communications/Security Contractors shall provide installers trained in all applicable codes, standards, regulations, and installation standards.

END OF SECTION

PART 1 GENERAL

1.1 WORK INCLUDED

1. Comply with Section 27 00 03 – General Specifications and Requirements for Communications.
2. Subcontractors shall not be acceptable to provide warranty unless pre-approved by the Technology Systems Consultant and the Owner at time of tender. Subcontractors will not be approved after tender is awarded.
3. The Communications Contractor shall provide a written 1-year warranty inclusive of all parts and labour for the end-to-end solution. The Communications Contractor shall also state and agree in writing to providing response for any warranty request within 24 hours during this warranty period.

1.2 ACCEPTABLE MANUFACTURERS

1. All equipment and products supplied shall be new and free of all manufacturer defects and delivery or installation damage.
2. All equipment and products supplied shall meet all manufacturer listed characteristics as identified in the latest manufacturer catalogue.
3. All products shall meet all applicable codes and standards and bare the UL/ULC label, be CSA approved and meet FCC/CRTC Regulations.
4. All products shall be provided in accordance with local, provincial, and national fire ratings for the installation on this project.
5. The only acceptable Manufacturers of an end-to-end solution for this project and as further specified in this document will be the following:

   Belden

1.3 CERTIFICATION

1. Certification shall be provided by the specified and selected product manufacturer directly to the Technology Consultant.
2. The Contractor is responsible for providing to the Technology Consultant a copy of the application for certification with 5 in days of project award.
3. Upon completion of the project the Contractor shall deliver to the Technology Consultant for the Owner a copy of the manufacturer's warranty information, certificate and or plaque. This information shall accompany the final documentation described further in these specifications.
4. The Contractor shall currently be an authorized installer of the manufacturer providing the warranty.

   Belden Certified Systems Vendor

5. Subcontractors shall not be acceptable to provide warranty unless pre-approved by the Technology Consultant and the Owner at time of tender. Subcontractors will not be approved after tender is awarded.

6. The Contractor shall provide a written 1-year warranty inclusive of all parts and labour for the end-to-end solution. The Contractor shall also state and agree in writing to providing response for any warranty request within 24 hours during this warranty period.

PART 2 - PRODUCTS

2.1 Not applicable to this Section.

PART 3 - EXECUTION

3.1 SCOPE

1. The project consists of the fit-out of one (1) floor, for Metro Hall, located at 55 John St. in the city of Toronto.

2. Supply of five bound copies of shop drawings for all products prior to placing material order to acquire written approval from the Technology Systems Consultant

3. Complete all final documentation requirements including documentation and site reviews to provide manufacturer's certification as per Section 27 00 11

4. The specific structured cabling system scope of this project includes but is not limited to:

   .1 Removal and disposal of all existing redundant communications cabling from within ceiling spaces, conduit, and partitions as well as all related accessories, including but not limited to J-hooks, termination blocks, patch panels, jacks, faceplates, surface mount boxes, systems furniture adapters, etc, as identified in Section 27 00 15 – Communications Cable and Equipment Removal Requirements.

   .2 Supply and installation of 4-pair UTP horizontal copper cabling and related accessories to support end-user data applications.

   .3 Supply and installation of cable tray pathways as indicated in this specification.

   .4 Supply and installation of new cabinets.

   .5 Supply and installation of backboards.

   .6 Supply and installation of all fire stop materials and/or mechanisms for all penetrations used for communications cabling.

   .7 Supply temporary and final record drawings as specified.

5. The specific electronic security system scope of this project includes but is not limited to:

   .1 Supply and installation of a new card reader including cabling, accessories, and software to the existing access control panel.

   .2 Relocate existing Access control including cabling, accessories, and software.

.3 Complete integration of new and relocated access control devices to pre-existing systems including, but not limited to, Access Control, CCTV, Alarm, Intercom systems and shall be coordinated with Owner's security group.

.4 Complete testing of each system in a timely fashion and in coordination with other trades and services to ensure completely tested systems prior to activation by the Owner.

.5 Test Electronic Safety and Security Systems operations based on a point-by- point walkthrough review.

.6 Supply and installation of all active and passive hardware and cables as specified within this document to support the Electronic Safety and Security Systems.

.7 Perform end-user training.

3.2 PHASING

1. This project shall be completed in (1) one phase. Co-ordination with the Owners staff (including but not limited to the IT staff) and other trades is imperative and shall form part of the scope of this project. This installation will not necessarily be completed over a continuous period and may be completed over two or more time periods to allow for co-ordination with other groups / trades.

END OF SECTION

PART 1 - GENERAL

1.2 WORK INCLUDED

1.1.1 Comply with Section 27 00 03 – General Specifications and Requirements for Communications.

1.3 SHOP DRAWINGS

1.1.2 Provide 5 copies of manufacturer prepared shop drawings identifying complete technical specifications for each product being supplied as part of the end-to-end solution including fire stopping, pathways and other miscellaneous products.

1.1.3 Shop drawings shall be stamped and signed "For Review" complete with date submitted.

1.1.4 Manufacturers shop drawings showing various model or styles shall be labelled with identification arrows showing which items are being proposed. Arrows shall be reproducible through standard photocopying.

1.1.5 Shop drawings shall be approved by the Technology Systems Consultant prior to starting installation and the Communications Contractor will be responsible for the cost of replacing of all installed product not approved.

1.1.6 Approved shop drawings shall be included in the Project Manual for this project.

1.4 PROJECT DOCUMENTATION

1.1.7 The Communications Contractor shall provide digitally marked record drawings showing all cable numbers on floor plans, rack elevations, backboard layouts and cable routing at the completion of the project. Drawings shall include all architectural and project changes. Provide within ten (10) days of completion of the project one (1) PDF copy for use by the Technology Systems Consultant.

1.1.8 The Communications Contractor shall include an allowance of $ 1,500 to be paid to the Technology Systems Consultant for the preparation of final record drawings and coordination of record documentation. The Technology Systems Consultant will coordinate and provide final delivery of record documentation to the Owner upon receipt of payment from the Communications Contractor.

1.1.9 Prepare a complete test report for each cable identifying a successful test on each cable, complete with the technician's signature and date. Test reports shall be full test reports in the testing software format and with one page per cable. Provide 1 soft copy on USB of test results with appropriate viewing software to the Technology Systems Consultant within ten (10) days of project completion for approval.

1.1.10 At the completion of the project be prepared to submit 1 copy of a project manual in a digital PDF copy to the Technology Systems Consultants for review and approval. This project manual shall include:

.1 Contractor's Name, contact information and lead installer/foreman's contact info

.2 Letter detailing, total cost of project (including changes), square footage, number of cable drops, project highlights, Architect/Interior Designer and Owner name and contact information.

.3 Final bill of materials

.4 Approved shop drawings

.5 WIMS data sheets on all applicable materials including fire stopping

.6 Maintenance and/or operation manuals for all equipment

.7 Connectivity database

.8 Test results

.9 Record drawings

.10 Letter of 1 year installation warranty

.11 Manufacturer's Certification and warranty documentation

1.1.11 Upon written approval from the Technology Systems Consultant prepare (3) additional project manuals for distribution to the Owner.

1.1.12 The Communications Contractor shall prepare a separate Data and Voice Connectivity Database in MS Excel spreadsheet format that includes but not limited to the following:

.1 Data - Horizontal cable number, active equipment port, backbone cable/strand and Owner assigned designation.

.2 Voice - Horizontal cable number, backbone pair, Telephone Switch/Node (TN) and Owner assigned designation.

.3 Provide (1) soft copy for the Owners use prior to move in.

1.1.13 Final documentation not provided within 30 days of project completion and with reasonable notification may result in the commissioning of another agent to prepare such documents. Costs for this work will be deducted from all Holdback amounts available to the Communications Contractor.

1.5 SITE DOCUMENTATION

1.1.14 The Communications Contractor shall be responsible for maintaining a complete set of record marked up drawings on site for the Technology Systems Consultants review at all times. Drawings shall be up to date with all architectural and project changes.

1.1.15 Maintain a log of date, time, and reason for any delays in performing the installation. Details shall include names, conditions, and specific reason for delay.

Part 2 PRODUCT

2.1 DOCUMENTATION REQUIREMENTS

2.1.1 The following items shall be delivered as scheduled after project award:

Delivery Item	Delivery Schedule	Presentation
Connectivity Diagrams (PDF)	10 days after project award	Email/Electronic PDF
Shop Drawings (PDF)	10 days after project award	Email/Electronic PDF
Monthly Draw Breakdown (PDF)	10 days after project award	Email/Electronic PDF

2.1.2 The following items shall be kept up to date during project construction.

Delivery Item	Delivery Schedule	Presentation
Continuously Updated Drawings	During construction on-site	Electronic PDF

2.1.3 The following items shall be delivered after project completion in a binder:

Delivery Item	Delivery Schedule	Presentation
Contractor's Information	10 Days after Cutover	Electronic PDF
Project Details	10 Days after Cutover	Electronic PDF
Final Bill of Materials	10 Days after Cutover	Electronic PDF
Approved Shop Drawings	10 Days after Cutover	Electronic PDF
WIMS Data Sheets	10 Days after Cutover	Electronic PDF
Maintenance / operation manuals	10 Days after Cutover	Electronic PDF
Record Test Results	10 Days after Cutover	Electronic PDF
Record Drawings (PDF)	10 Days after Cutover	Electronic PDF
Contractor's 1 Year Warranty	10 Days after Cutover	Electronic PDF
Manufacturer Warranty	10 Days after Cutover	Electronic PDF
Programming	10 Days after Cutover	Electronic PDF

2.1.4 Should the Owner or General Contractor require hardcopies of any documents listed here as to be provided in an electronic format, the Communications Contractor shall provide as requested at no additional cost.

Part 3 EXECUTION

3.1 Not applicable to this Section.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1. Comply with Section 27 00 03 – General Specifications and Requirements for Communications.

1.2 GENERAL

1. Use only fire stopping products that have been tested for specific fire resistance rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.

1.3 MATERIALS

1. Products manufactured by Hilti, Specified Technologies Inc. (STI), or equivalent are acceptable.
2. Obtain fire stop systems for each type of penetration and construction condition indicated from a single manufacturer (i.e. Do not mix manufacturers for the same type of penetration).

1.4 PERFORMANCE REQUIREMENTS

1. Fire Stop Systems shall conform to the fire (F), hose (H) and temperature (T) ratings of Codes and shall have a flame spread rating of 25 or less, National Fire Protection Association (NFPA Class "A").
2. Fire Stop Systems acceptable for this project are those that have been tested to the CAN/ULC S115 Standard.
3. Fire Stop Systems shall be CSA approved, non-permanent, dielectric, water resistant, non-hardening, permanently pliable/re-enterable putty along with the appropriate damming or backer materials.
4. Fire stopping shall maintain a minimum one-hour rating, meet applicable Federal, Provincial, Local building codes, and be tested by a SCC and accredited Third Party Testing Agency in accordance with the Standards.
5. In locations containing high moisture, fire stopping shall be compatible with Formalin.
6. Fire rated fittings allowing easy cable additions may be used. All non-permanent caulking or foams shall be replaced with the removal or addition of any cabling before final acceptance by the owner.
7. Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur.
8. Where non-mechanical products are utilized, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristic during or after construction.
9. Where it is not practical to use a mechanical device, openings within floors and walls designed to accommodate communications cabling shall be provided with re-enterable products that do not cure or dry.

10. Openings for cable trays shall be sealed using re-enterable fire stopping pillows.

1.5 QUALITY ASSURANCE

1. Products/Systems: Provide fire stopping systems that comply with the following requirements:

   .1 Fire stopping tests are performed by a qualified, testing and inspection agency. A qualified testing and inspection agency is UL, or another agency performing testing and follow-up inspection services for fire stop system acceptable to authorities having jurisdiction.

   .2 Fire stopping products bear the classification marking of qualified testing and inspection agency.

2. Installer Qualifications: Experience in performing work of this section who is qualified by the fire stopping manufacturer as having been provided the necessary training to install fire stop products in accordance with specified requirements.

1.6 DELIVERY, STORAGE AND HANDLING

1. Manufacturer's original, unopened, undamaged containers, identification labels intact identifying product and manufacturer, date of manufacture; lot number; shelf life, if applicable; qualified testing and inspection agency's classification marking; and mixing instruction for multicomponent products.

2. Handle and store products according to manufacturer's recommendations published in technical materials. Leave products wrapped or otherwise protected and under clean and dry storage conditions until required for installation.

3. Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.7 PROJECT CONDITIONS

1. Do not install fire stopping products when ambient or substrate temperatures are outside limitations recommended by manufacturer.

2. Do not install fire stopping products when substrates are wet due to rain, frost, condensation, or other causes.

3. Maintain minimum temperature before, during, and for a minimum 3 days after installation of materials.

4. Do not use materials that contain flammable solvents.

5. Coordinate construction of openings and penetrating items to ensure that through-penetration fire stop systems are installed according to specified requirements.

6. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems.

7. Schedule installation of fire stopping after completion of penetrating item installation but prior to covering or concealing of openings.

8. Supply and install temporary fire stopping at the end of every work shift or when location of work is changing from one work area to another. This shall be done to maintain the penetration's fire rating in areas where no work is being done.

PART 2 - PRODUCTS

2.1 FIRE STOP GROMMETS & DISCS

1. STI SpecSeal Brand molded two-piece grommet having a foam fire and smoke sealing membrane that conforms to the outside diameter of the individual cable.

2. Shall be used only for penetrations of individual 4-pair UTP or F/STP cables.

Specified Product:

	Part No.	# Of Cables	Hole Diameter
Hilti	CFS-D	1	1” (25mm)
Specified Technologies Inc. (STI)	RFG1	1	9/16” (14mm)
Specified Technologies Inc. (STI)	RFG2	2	1” (25mm)

2.2 FIRE STOP SEALANTS

1. STI SpecSeal® Brand single component latex formulations that upon cure do not re-emulsify during exposure to moisture.

Specified Product:

Hilti	CP 606 FS-ONE MAX Sealant
Specified Technologies Inc. (STI)	SpecSeal® Series SSS Sealant
Specified Technologies Inc. (STI)	SpecSeal® Series LCI Sealant

2.3 FIRE STOP PUTTY

1. STI SpecSeal® Brand intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibres or silicone compounds.

Specified Product:

Hilti	CP 617 Firestop Putty Pads
Hilti	CP 618 Firestop Putty Stick
Specified Technologies Inc. (STI)	SpecSeal® Series SSP Putty

2.4 FIRE RATED CABLE PATHWAYS

1. STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill.

Specified STI Products:

EZ-Path Multi-Gang Wall Bracket	EZP544W
EZ-Path (No Options)	EZD44
Single EZ-Path Kit	EZDP44

Only where wall thickness exceeds 10” use the following
(adjust quantity of EZ-Path units and accessories to suit cable quantity):

Single EZ-PATH Kit	EZDP33FWS
Two Gang EZ-PATH Kit	EZDP233GK
Three Gang EZ-PATH Kit	EZDP333GK
Four Gang EZ-PATH Kit	EZDP433GK
Radius Control Module	RCM33
Extension Module	EZD33E

Specified Hilti Products:

Firestop Gang Plate	CFS-SL GP

Single Speed Sleeve Kit	CFS-SL SK

Only where wall thickness exceeds 10” use the following
(adjust quantity of Sleeve units and accessories to suit cable quantity):

Single Speed Sleeve Kit	CP 653
Two Gang Speed Sleeve Kit	CFS-SL GP, CFS-SL GP CAP, and Speed Sleeves
Three Gang Speed Sleeve Kit	CFS-SL GP and Speed Sleeves
Four Gang Speed Sleeve Kit	CFS-SL GP and Speed Sleeves
Extended Speed Sleeve	CFS-SL GA L

PART 3 - EXECUTION

3.1 EXAMINATION

1. Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for installation of fire stopping in accordance with manufacturer’s installation instructions and technical information.
2. Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.
3. Provide masking and temporary covering to protect adjacent surfaces.
4. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

1. Install through-penetration fire stop systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.
2. Comply with manufacturer’s instructions for installation of fire stopping products.

3.3 FIELD QUALITY CONTROL

1. Keep areas of work accessible until inspection by authorities having jurisdiction.
2. Where deficiencies are found, repair fire stopping products so they comply with requirements.

3.4 NON-MONITORED PENETRATIONS

1. Where fire watch is not in effect, or the Communications Contractor has not been able to confirm whether fire watch is in effect, all fire penetrations, whether all cables have been pulled or not, removed or not, shall be fire stopped at the end of every workday prior to the Communications Contractor leaving the site. At no time shall a penetration be un-attended or without fire stopping material in areas where work is not in progress.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1. Comply with Section 27 00 03 – General Specifications and Requirements for Communications.

1.2 GENERAL

1. The Communications Contractor shall confirm with the Technology Systems Consultant prior to the start-up of cable removal.
2. The Communications Contractor shall provide to the Technology Systems Consultant a detailed schedule outlining locations and times for cable removal.
3. In occupied areas the Communications Contractor shall re-install ceiling tiles after every shift.

1.3 REMOVAL SCOPE

1. Unless otherwise noted on drawings, the removal scope shall include the entire project area, including all backbone leaving / entering project area, as well as all existing cabling from prior tenants / users.
2. Products to be removed shall include but not be limited to copper and optical fibre backbone cabling, UTP cabling, FTP cabling, STP cabling, Coaxial cabling, Type 1 cabling, outlets, patch cords, insert plates, surface mount boxes, systems furniture adapters, patch panels, IDC blocks, labelling, j-hooks, racks, cabinets, and accessories.

PART 2 - PRODUCTS

1.1 Not applicable to this Section.

PART 3 - EXECUTION

2.1 IDENTIFICATION OF CABLING

1. Prior to removal of any communications cable or accessory the Communications Contractor shall identify all existing non-active cabling. The Communications Contractor shall tone out any cables slated to be removed to ensure that the intended cables are inactive.

2.2 CABLE AND ACCESSORIES DISPOSAL

1. The Communications Contractor shall on a daily basis dispose of and remove from site removed cabling and accessories in environmental way.
2. The Communications Contractor shall turn over to the Owner any requested equipment and accessories such as racks, cabinets, patch panels and voice connectivity hardware for future Owner use.
3. LEED POINTS / PROOF / RECEIPT OF PROPER DISPOSAL

2.3 FIRE STOPPING

1. Refer to Section 27 00 13 – Fire Stopping for Communications, for all fire stopping requirements where cables passing through fire rated partitions and/or mechanisms are removed. All fire stopping disturbed during cable and equipment removal shall be made good, or shall be installed where it may have been non-existent.

END OF SECTION

PART1 - GENERAL

1.1 WORK INCLUDED

1. Comply with Section 27 00 03 – General Specifications and Requirements for Communications.

1.2 GENERAL

1. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labelled, and documented by the Communications Contractor as detailed in this section.
2. Product specifications, general design considerations and installation guidelines are provided in this section.
3. The Communications Contractor shall meet or exceed all requirements for the cable system described in this section.
4. Local building and electrical codes shall be adhered to.
5. All communications components including, entrance lugs, entrance terminal frames, racks, cabinets, cable tray, ladder racks, metallic pathways, enclosures, and other components noted on drawings shall be bonded to an independent grounding system and in accordance with local codes and standards, TIA/EIA J-STD-607-A, ANSI/TIA-942 and IEEE Std.1100 and these specifications.
6. Labelling shall conform to TIA/EIA-606.
7. Grounding system shall include a local copper Telecommunications Grounding Busbar (by Division 26) in each entrance facility and equipment room bonded to a Telecommunications Grounding Backbone (by Division 26).
8. The TBB shall be bonded directly to the Telecommunications Main Grounding Busbar (by Division 26). The TMGB shall be bonded directly to the building entrance grounding system and meet all local codes and standards as noted above.
9. The grounding system shall be visually verifiable and adequately sized to handle expected currents safely.
10. All grounding conductors and busbars shall be made of copper.
11. The grounding system shall be intentional, visually verifiable, adequately sized to handle expected currents safely, and direct these currents away from network equipment. As such, grounding shall be purposeful in its design and installation.
12. Lugs, HTAPs, grounding strips, and busbars shall be UL Listed, and CSA certified and made of premium quality tin-plated electrolytic copper that provides low electrical resistance while inhibiting corrosion. Antioxidant shall be used when making bonding connections in the field.

1.3 LUGS

1. Wherever possible, two-hole lugs shall be used. All lugs shall be irreversible compression. Lugs with inspection windows shall be used in all non-corrosive environments so that connections may be inspected for full conductor insertion (battery rooms are an exception where windowless lugs may be used).

2. Die index numbers shall be embossed on all compression connections to allow crimp inspection.

1.4 CABLE ASSEMBLIES

1. Cable assemblies shall be UL Listed and CSA Certified. Cables shall be a distinctive green or green/yellow in color, and all jackets shall be UL, VW-1 flame rated.

1.5 TELECOMMUNICATIONS GROUNDING BUSBAR

1. The Telecommunications Grounding Busbar (TGB) shall be supplied and installed by Division 26.

1.6 TELECOMMUNICATIONS BONDING BACKBONE REQUIREMENTS

1. The Telecommunications Grounding Busbar within each telecommunications space shall be bonded to the building ground riser with a Telecommunications Bonding Backbone. The TGB and the TBB shall be supplied and installed by Division 26.

2. The gauge of the TBB shall be determined based on TIA/EIA J-STD-607-A. The table below is shown for reference.

TBB Length in Linear meters (feet)	TBB Size (AWG)
Less than 4 (13)	6
4-6 (14-20)	4
6-8 (21-26)	3
8-10 (27-33)	2
10-13 (34-41)	1
13-16 (42-52)	1/0
16-20 (53-66)	2/0
Greater than 20 (66)	3/0

PART 2 - PRODUCTS

2.1 COMMON BONDING NETWORK

1. The Common Bonding Conductor within each Entrance Facility, Data Centre, Computer Room, Telecommunications Room, LAN Room, etc. shall be a green or green/yellow jacketed #2 copper conductor. The installation route shall be as shown on drawings.

2. The Common Bonding Conductor shall be routed in as straight a path as possible.

2.2 GROUNDING CLAMPS

1. Where a grounding conductor is routed through a metal conduit, the Communications Contractor shall use a #6 AWG copper conductor with green or green/yellow jacket to bond the conduit to the grounding conductor routed through the metal conduit. Series GPL grounding clamps shall be used to bond to the conduit and series HTWC HTAP with clear cover shall be used to bond to the grounding conductor.

2.3 COMMUNICATIONS GROUNDING AND BONDING CONDUCTOR LABEL KIT

1. Telecommunications Grounding and Bonding Conductor Label Kits shall be supplied and installed by the Communications Contractor at every rack and cabinet as well as one for every Telecommunications Grounding Busbar.

Specified Product:

Harger	GRNTAG607PK10
Panduit	LTYK

2.4 CODE CONDUCTOR, TWO-HOLE, LONG BARREL WITH WINDOW LUG

1. Where lugs are required for bonding, the Communications Contractor shall supply and install Code Conductor, Two-Hole, and Long Barrel with Window Lugs.
2. Code Conductor, Two-Hole, Long Barrel with Window Lugs shall be supplied and installed by the Communications Contractor as required.
3. Lugs shall be tin plated, irreversible compression, have NEMA hole sizes and spacing and shall meet NEBS Level 3.

2.5 CODE/FLEX CONDUCTOR HTAP

1. Code/Flex Conductor HTAPs shall be supplied and installed by the Communications Contractor as required.

2.6 CLEAR COVERS FOR HTCT HTAP

1. Clear Covers for HTCT HTAPs shall be supplied and installed by the Communications Contractor (each HTAP requires one clear cover).

2.7 GROUNDING CLAMP, U-BOLT, BRONZE

1. Each conduit entering/leaving a telecommunications space/room shall be bonded to the grounding system using a Series GPL Bronze U-Bolt Grounding Clamp.

2.8 LADDER TRAY / BASKET TRAY GROUNDING

1. Bonding network jumpers shall be supplied and installed by the Communications Contractor to bond the tray to the grounding system.

2.9 ANTIOXIDANT

1. Antioxidant shall be used by the Communications Contractor when making bonding connections.

2.10 BONDING SCREWS

1. Bonding screws shall have serrations on the bottom of screw to remove paint from patch panel to bond patch panel to rack or cabinet rails.
2. Bonding screws shall be thread-forming to remove paint from threaded rack or cabinet rail holes to bond patch panel to rack or cabinet rails.
3. The Communications Contractor shall supply and install four (4) screws for every patch panel (copper and optical fibre) as well as for every Owner supplied switch (assume 48 port switches).

   Specified Product:

Panduit	RGTBSG-C	#12-24 screws
Panduit	RGTBS1032G-C	#10-32 screws
Panduit	RGTBSM6G-C	M6 screws
Panduit	RGTBSM5G-C	M5 screws

2.11 BONDING CAGE NUT

1. Specified Product: Panduit CNB4K

2.12 BOND CLAMP

1. Specified Product:

Belden	X9905753	For 0.75” or larger cables
Belden	X9905754	For 0.75” or smaller cables
Belden	AX100226	Six-Position Ground Bracket

2.13 CABINET GROUNDING

1. Cabinet Grounding Strip Kit

.1 Series RGS grounding strips shall have EIA Universal mounting hole pattern and shall be made of high conductivity, low resistance wrought copper and tin plated.

.2 Series RGS grounding strip kits shall come complete with four (4) grounding strips, 0.16 oz. (5cc) of antioxidant and bonding studs.

.3 One series RGS rack grounding strip kit with four (4) grounding strips shall be supplied by the Communications Contractor for every cabinet. Each grounding strip shall be mounted to each cabinet equipment rail.

Specified Product:

Panduit	RGS134-1Y	for #12-24, M6, #10-32 or M5 mounting hole rails
Panduit	RGS134B-1	for cage-nut rails (pack of 1 strip)
Panduit	RGS134B-10-1	For cage-nut rails (pack of 10 strips)

2. Grounding Busbar Kit

.1 The Grounding Busbar shall be made of high conductivity, low resistance wrought copper and tin plated.

.2 One Cabinet Grounding Busbar kit shall be supplied and installed by the Communications Contractor for every cabinet.

Specified Product:

Panduit	RGRB19U	20 holes
Panduit	RGRB19Y	14 holes
Panduit	RGRB19CN	20 holes for cage-nut

3. Front to Back Rail Jumper Kit

.1 The Front to Back Rail Jumper Kit shall be made of #6 AWG green or green/yellow jacketed copper conductors to bond the rear cabinet rails to the front cabinet rails.

.2 The Front to Back Rail Jumper Kit shall come complete with thread-forming screws or bonding studs.

.3 One Panduit series CGJ Front to Back Rail Jumper Kit shall be supplied and installed by the Communications Contractor for each cabinet.

Specified Product:

Panduit	CGJ620U	for #12-24 or M6 holes and a 24” deep cabinet
Panduit	CGJ630U	for #12-24 or M6 holes and a 36” deep cabinet
Panduit	CGJ640U	for #12-24 or M6 holes and a 42” deep cabinet
Panduit	CGJ620UA	for #10-32 or M5 holes and a 24” deep cabinet
Panduit	CGJ630UA	for #10-32 or M5 holes and a 36” deep cabinet
Panduit	CGJ640UA	for #10-32 or M5 holes and a 42” deep cabinet
Panduit	CGJ620UB	for cage-nut rails and a 24” deep cabinet

Panduit	CGJ630UB	for cage-nut rails and a 36” deep cabinet
Panduit	CGJ640UB	for cage-nut rails and a 42” deep cabinet

2.14 COMMON BONDING NETWORK JUMPER

.1 The Common Bonding Network Jumper shall be made of #6 AWG green or green/yellow jacketed copper conductor 96” long with one end factory terminated to lug.

.2 The Common Bonding Network Jumper kits shall come complete with 0.16 oz. (5cc) of antioxidant and thread-forming screws.

.3 One Common Bonding Network Jumper shall be supplied and installed for every cabinet.

Specified Product:

Harger	RGJ67G1082AKIT
Panduit	RGREJ696Y

.4 Where a Common Bonding Network has not been specified the Communications Contractor shall supply and install a Code Conductor Two Hole Long Barrel with Window Lug to bond the Common Bonding Network Jumper directly to the Telecommunications Grounding Busbar.

Specified Product:

Harger	GECLB62A
Panduit	LCC6-14JAW-L

.5 Where a Common Bonding Network has been specified the Communications Contractor shall supply and install a Code/Flex Conductor HTAP Kit to bond the Common Bonding Network Jumper to the Common Bonding Network.

Specified Product:

Harger	CT2248
Panduit	HTWC250-2-1

2.15 ELECTROSTATIC DISCHARGE PORT

.1 The Electrostatic Discharge Port shall accommodate a standard ESD wrist strap 4mm plug.

.2 The Electrostatic Discharge Port kits shall come complete with an ESD protection sticker, 0.16 oz. (5cc) of antioxidant and thread-forming screws or bonding studs.

.3 The Communications Contractor shall supply and install two Electrostatic Discharge Ports for every cabinet. One ESD port shall be mounted directly to the cabinet grounding strip on the back of the cabinet at approximately 48” AFF, and the other shall be mounted directly to the cabinet grounding strip on the front of the cabinet at approximately 48” AFF. ESD ports may be mounted on top of patch panels or horizontal cable managers.

Specified Product:

Panduit	RGESD2-1	Kit c/w #12-24 and M6 screws
Panduit	RGESD2A-1	Kit c/w #10-32 and M5 screws
Panduit	RGESD2B-1	Kit c/w bonding studs

PART 3 - EXECUTION

3.1 GENERAL

1. Structured grounding kits shall be TIA-942 compliant, listed for their purpose with a nationally recognized testing laboratory, and RoHS compliant.
2. Grounding strip shall comply with EIA universal mounting hole spacing and mount to standard 19-inch and 23-inch racks and cabinets.
3. All components shall be bonded to the rails with paint piercing hardware.
4. Electrostatic discharge (ESD) ports shall be mounted to the front and back of the rack(s) and/or cabinet(s).
5. Equipment shall be bonded to the grounding strip with a discrete jumper and two-hole long barrel compression lugs.
6. There shall be a #6 AWG copper code discrete jumper that terminates on the mesh common bonding network (MCBN) with a compression HTAP and attaches to the grounding strip using a two-hole, long barrel compression lug. The compression lugs shall meet NEBS Level 3 Criteria and have inspection windows.
7. All jumpers shall have green or green-and-yellow VW-1 rated insulation.
8. Where rack sections bolt together, paint piercing grounding washers shall be used on both sides, under the head of the bolt and between the nut and the rack.
9. The Communications Contractor shall ensure a complete grounding system is installed for the project. If any portion of the system to be installed by Division 26 is incomplete it shall be the responsibility of the Communications Contractor to advise the Technology Systems Consultant.

END OF SECTION

PART1 - GENERAL

1.1 WORK INCLUDED

1. Comply with Section 27 00 03 – General Requirements.

1.2 GENERAL

1. The Communications Contractor shall be responsible for measuring and confirming cable pathways prior to installation of any cabling to ensure no cabling will exceed the specified distance limitations. Where the distance limitations are exceeded, the Communications Contractor shall inform the Technology Systems Consultant prior to installation of cabling. No compensation for removal of cabling will be accepted if not adhered to.
2. The Communications Contractor shall be responsible for installing and providing pulling strings, ropes and fishing walls wherever conduit is not installed, or conduit is installed without these provisions.

1.3 INDOOR CABLE DISTRIBUTION

1. Ensure ANSI/EIA/TIA-568-B installation practices are followed for all indoor cable distribution.
2. The Communications Contractor shall install and distribute cabling using riser sleeves, conduit, communications cable tray, floor ducts systems and/or surface raceways as indicated on drawings and as supplied and installed by Division 26.
3. All cabling extending beyond conduit and /or cable tray pathways shall be supported using J-hooks and/or Cable Slings up to the point of termination complete with “Velcro” Ty-raps supplied and installed by the Communications Contractor, in accordance with these specifications.
4. Innerduct shall be supplied and installed by the Communications Contractor for all fibre optic cabling not indicated shall be installed in conduit and at locations fibre optic cabling leaves a conduit. Innerduct shall be as further described in this specification.

PART 2 - PRODUCTS

2.1 OVERHEAD WIRE BASKET TRAY

1. Provide wire basket of types and sizes indicated with all required splicing and mounting hardware.
2. Wire basket crosswire to be constructed with shaped wire to provide flat surface for cable support, avoiding pressure points or cable strain. Round wire construction shall not be allowed.
3. Wire basket shall be made of high strength steel wires and formed into a standard 2 inch by 4 inch wire mesh pattern with intersecting wires welded together. All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.

4. Wire diameter shall be 0.195” (5mm) minimum on all mesh sections up to 16 linear inches. Wire diameter linewire shall be 0.234” (6mm) minimum on all mesh sections in excess of 16 linear inches.

5. All straight section longitudinal wires shall be constructed with a continuous top wire safety edge. Safety edge must be the WBT “Canadian-Weld” on all tray sizes.

6. All fittings shall be field formed, from straight sections, in accordance with manufacturer’s instructions.

7. All Tray sections and splicing assemblies shall be UL/C-UL Classified as an Equipment Ground Conductor (EGC).

8. The cable tray shall be installed complete with splice bars, “uni-strut” trapeze supports, threaded rod, ceiling anchors and all manufacturer recommended installation components following manufacturer’s installation instructions and recommendations.

Specified Product:

	Description	Part No.
WBT	Tray	WBT(4”) X (12”) X (10’) (Hot Dipped Galvanized
WBT	Cable drop control (“waterfall”)	VERTICAL DOWN
WBT	Bend radius control corner	CABLE GUIDE
WBT	Attachment to fill fitting gap	FITTING ATTACHMENT 2
WBT	Attachment to fill fitting gap	FITTING ATTACHMENT 4/6
WBT	Attaches tray directly to rack	RACK ATTACHMENT
WBT	Used to splice tray sections	SPLICE KIT
WBT	Used to splice tray sections	WASHER SUPPORT
WBT	Used to splice tray sections	BAR SPLICE
WBT	Used to splice fittings	CORNER SPLICE
WBT	Ceiling support for 12” tray	CEILING SUPT 12

2.2 VELCRO WRAPS

1. Velcro wraps shall be supplied and installed to support and neatly bundle all cabling.

2. No nylon or plastic wraps will be permitted on this project and will be removed and replaced at the expense of the Electronic Safety and Security Contractor.

3. Velcro Wraps shall be black in colour.

Specified Product:

		Width	Tensile Strength
Panduit	HLM-15R0	0.330″	18
Panduit	HLS-15R0	0.750″	50
Panduit	HLS-75R0	0.750″	50
Panduit	TTS-20R0	0.750″	40
Panduit	TTS-35R3-0	0.750″	40

PART 3 - EXECUTION

3.1 GENERAL

1. All pathways shall be installed to run parallel to building lines at all times.
2. Pathways shall be installed in coordination with other trades in order to minimize interferences and obstructions. The Communications Contractor shall be responsible for relocating installed pathways at no cost to the Owner.
3. All cable supports shall be installed to the permanent structure of the building and be limited to areas that will not damage the structural stability such as tensioned beams and slabs. It is the responsibility of the Communications Contractor to submit information to the structural engineer for review and approval prior to installation.
4. Anchors for J-hooks and/or Cable Slings shall not be drilled into post tensioned beams under any circumstances. All anchors shall be drilled into slab.
5. Pneumatic hammers shall not be used unless the Communications Contractor has written authorization from the building owner/landlord.
6. The Communications Contractor shall minimize the removal/disturbance of fire spray insulation while installing cable supports and/or accessories.

3.2 DATA AND / OR VOICE INDOOR CABLE DISTRIBUTION

1. All pathways and cabling installation shall maintain clearances from all electrical and heat sources as outlined below.

Fluorescent Fixtures	15 cm
Electrical distribution cabling and conduits less than 1KVA	1.0 m
Electrical distribution cabling and conduits greater than 1KVA	3.0 m
Transformers and Motors	1.2 m
HVAC system including ducts	30 cm
Mechanical piping	15 cm

2. Prepare all conduits and pathways prior to installation of cabling. This shall include bushing or reaming all conduit openings, pulling of wire brush and mandrel to clean out ducts and identifying any potential cause of damage to cabling during installation. Report all items to the Technology Systems Consultant immediately.
3. When installing cables in stacked duct banks install cabling in lower ducts leaving upper ducts for future installations.

3.3 FIRE STOPPING

1. For all fire stopping requirements refer to Section 27 00 13 – Fire Stopping for Communications.

3.4 GROUNDING

1. For all grounding and bonding requirements refer to Section 27 05 26.10 – Grounding and Bonding for Communications.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1. Comply with Section 27 00 03 – General Specifications and Requirements for Communications.

1.2 RACK AND CABINET LABELLING

1. Each rack and cabinet shall be labelled with one label on the front (top) and one label on the back (top).

1.3 ACTIVE EQUIPMENT LABELLING

1. Each piece of active equipment, such as switches, routers, local ups, etc. shall be labelled with one label on the front and one label on the back.

1.4 LABELLING SCHEMES

1. The Communications Contractor will be responsible to confirm labelling schemes with the Technology Systems Consultant prior to preparation and installation of any labelling.

   Rack and Cabinet Labelling Scheme:

   RXX where: R = Row (alphabetical character starting with ‘A’)
   XX = Rack or Cabinet number

   Active Equipment Labelling Scheme: tbd

PART 2 - PRODUCTS

2.1 RACKS AND CABINETS

1. Racks and Cabinets shall be labelled using lamacoid plates.
2. Lamacoid plates shall be black background with white letters.
3. Lamacoid plate letters shall be 1” high.
4. Lamacoid plates shall be no more than 2” high.
5. Length of lamacoid plates shall be as required to accommodate number of characters.

PART 3 - EXECUTION

3.1 GENERAL

1. All labels shall be printed on a laser printer. No handwritten labels shall be accepted.

3.2 RACK AND CABINET LABELLING

1. Rack and cabinet labelling shall be installed on clean and dry racks and cabinets and mounted on the top rail of each rack and each cabinet, at the front and at the rear.
2. Lamacoid plates shall be mounted to each rack and cabinet with screws. The Communications Contractor shall drill racks and cabinets prior to any cabling or equipment is mounted.
3. Adhesive shall not be accepted as a method of securing lamacoid plates to racks and cabinets.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1. Comply with Section 27 00 03 – General Specifications and Requirements for Communications.

1.2 GENERAL

1. All Communications equipment rooms shall be always kept clean and free of debris, including during construction.

1.3 LOCATION OF EQUIPMENT

1. Cabinets, racks, brackets, backboards and devices may be relocated prior to installation from the location shown on contract documents a distance of up to 3.05 m (10'-0") without adjustment to the contract price.

1.4 TELECOMMUNICATIONS ROOMS (TR)

1. Plywood backboards shall be provided as detailed on the drawings.
2. All racks, cabinets, and/or brackets shown on drawings shall be provided by the Communications Contractor unless otherwise noted.
3. Cable tray and pathways within the TR shall be provided by Division 26 unless otherwise noted.
4. The Communications Contractor shall supply and install cabling waterfalls for all locations cabling drops from the cable tray into racks, cabinets and backboards.

PART 2 - PRODUCTS

2.1 TELECOMMUNICATIONS CABINETS

1. Cabinets shall be supplied and installed complete with all accessories to provide a complete cabinet as indicated below.
2. Cabinets shall be floor mounted, freestanding and have the ability to be ganged together.
3. Cabinets shall have a minimum capacity of 44U, with mounting holes as per EIA-310-C.
4. Cabinets shall have (6) knockouts on top and be able to accept fans or chimney extensions.
5. Shelving shall be able to bear 200 lbs. in a retreated or extended position.
6. Each server cabinet shall be black, 30" x 48" and include the following components:

Specified Product: Description	Chatsworth	Qty
Zetaframe cabinet, 45U x 750W x 1200D • Glacier white • Two pair 19"eia square punched rails with three (3) 1u x 19"eia Zero-U brushed openings • Top panel with four (4) brush-sealed cable openings • Caster only kit – rigid in front, swivel in rear • Leveler only kit • Globalframe style perforated metal door -install front • Single-point keyed lock -install front • Double perforated metal door -install rear • Three-point keyed lock -install rear • Solid side panel -install left • Solid side panel -install right • Air dam kit • (2) Short finger vertical cable manager without cover - install: Rear-left rail - rear-right rail • (1) Cable lashing panel, 2.75"w (70mm) with cable bundle swivels - Install: rear-right • (1) Full-height dual pdu bracket for 2.2"w (56mm) pdu - install: Rear-right • (1) Standard dual 2-piece pdu bracket kit • Common parts kit, zf, ul • Packaging kit	TSZ1058000	1
Snap-In Filler Panel; 1 RMU x 19"W (482.6 mm); Glacier White	34537-E02	50
Snap-In Filler Panel; 2 RMU x 19"W (482.6 mm); Glacier White	34538-E02	2
Clik-Nut Hardware Kit; M6 Cage Nuts and Screws; 250 Count; Zinc	76543-002	250
USB Temperature and Humidity Sensor Attaches to the USB port on eConnect PDU or Network Controller Module	14665-001	2

2.2 PLYWOOD BACKBOARDS

1. All backboards supplied and installed for this project shall be constructed of ¾” thick, fire rated, 4’ wide x 8’ high, one side good plywood as noted on drawings.
2. Unless otherwise noted, plywood sheets shall be placed vertically.
3. All backboards shall be painted with two (2) coats of fire retardant non-conductive white paint. “Fire Rating” stamp shall be left visible (unpainted) to allow for confirmation of rating.
4. Communications Contractor shall supply and install all backboards as noted on Communications Drawings including for use by others.

5. Offset backboards:
   - .1 Shall be mounted to 2”x6” studs.
   - .2 All cables shall be fed from behind the backboard unless otherwise noted.
   - .3 Install offset backboards where required as shown on drawings.
6. Surface mounted (flush) backboards:
   - .1 Shall be used for wall mount brackets, wall mount double swing-out cabinets, wall mount racks, telephone equipment, service provider equipment, lightening protection, horizontal cables, riser cables, IDC punch down blocks, CATV equipment, and/or any other use as identified in the scope of work for this project.
   - .2 Install surface mounted (flush) backboards where required as shown on drawings.

2.3 CABLE DROP CONTROL (“WATERFALLS”)

1. Cable drop control fittings shall be manufactured by the cable tray manufacturer. For further information, refer to Section 27 05 28.10 – Pathways for Communications.

PART 3 - EXECUTION

3.1 GENERAL

1. The Communications Contractor shall provide a complete installation and be responsible for coordination within all telecommunications rooms. Installations and locations of all equipment shall be as noted on drawings. The Communications Contractor shall confirm final layout before proceeding and be responsible to install equipment and fittings.
2. Any cutting or patching required for installation of any telecommunications component will be the responsibility of the Communications Contractor.

3.2 RACKS AND CABINETS

1. Install racks and cabinets in positions shown and gang as required with manufactured recommended products. All racks and cabinets shall be level and clean of all dust and debris.
2. The Communications Contractor shall anchor all racks to the floor, raised floor or wall in the location indicated.
3. All racks shall be installed without any applied or screened labelling containing any name or information other than the original manufacturer’s identification.
4. Install all accessories with mechanical fasteners, including power bars permanently to racks to provide a complete solution.

3.3 GROUNDING AND BONDING

1. For all grounding and bonding requirements refer to Section 27 05 26 – Grounding and Bonding for Communications.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1. Comply with Section 27 00 03 – General Specifications and Requirements for Communications.

1.2 GENERAL

1. The power cord must be a minimum 6 feet in length to reach up to the ladder tray or down to the floor where it will plug into a receptacle (supplied by Division 26).

2. The power bar(s) shall be UL/ULC listed and shall meet UL/ULC 1363 and 1449 requirements.

Specified Product:

Brand	Model Number	
Chatsworth	EA-3014-CE	Monitored eConnect PDU Redundancy Pack; 1 Black/1 Glacier White; Vertical; For 42U & Higher Cabinets; L21-30 Input; (30) C13+(6) C19 + (6) 5-20 Outlets; 8.6kW; 149°F (65°C); Secure Array IP Consolidation; Phase-Balance Locking Outlets; Field-Replaceable Controller; +/- 1% Metering Accuracy; LCD Display; 10/100/1000MB Port; Onboard GUI; SNMPv1/v2/v3; RESTful API, CLI; LDAP & Radius Integration; HTTPs; Environmental Sensor and Electronic Lock Integration Ready

PART 2 - PRODUCTS

2.1 MATERIALS

1. Each active equipment cabinet shall come complete with two vertical power bars.

2. The power bar(s) shall be UL/ULC listed and shall meet UL/ULC 1363 and 1449 requirements.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

1. Mount power bars to rear vertical cable managers of cabinet(s).

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1. Comply with Section 27 00 03 – General Specifications and Requirements for Communications.

1.2 GENERAL

1. Horizontal cabling shall be installed in pathways indicated on drawings and as per Section 27 05 28 of this specification.

2. All cables shall be neatly bundled and installed as per the manufacturer's guidelines or the standards in these specifications; whichever is more stringent.

3. Ensure that all cables are sufficiently long to allow for slack, vertical runs, wastage, connectorization and future moves.

4. The maximum horizontal run length shall not exceed 90 meters. If the 90-meter constraint cannot be met, the Communications Contractor shall notify the Technology Systems Consultant immediately (prior to installation).

PART 2 - PRODUCTS

2.1 HORIZONTAL UNSHIELDED TWISTED PAIR (UTP) COPPER CABLING

1. All horizontal cabling shall be UTP, 4 pair, minimum 22 AWG, solid copper conductor, compliant with EIA/TIA cable category as identified below.

2. The cable shall be CSA certified and stamped with CMP or CMR rating accordingly.

3. All UTP cables shall meet requirements identified below.
   Specified Product:

	Cat.	Rating	Colour	Series[1]	System	Termination
Belden	6A	CMR/FT6		10GXS	Data	Patch Panel

Notes: [1] Series or Product Codes shown are not colour specific.

PART 3 - EXECUTION

3.1 HORIZONTAL UTP CABLING

1. UTP cabling shall be terminated as per manufacturer's guidelines and remove only enough cable jacket to perform termination.

2. Untwist pairs a maximum of 13 mm (1/2") for all categories of cables.

3. Provide a minimum of 3.0 m (10'-0") of slack at both ends of each cable. Neatly coil slack and attach to ladder tray or provide independent support in ceiling. Slack for workstation outlets shall be located above outlet in ceiling space.

4. UTP cabling shall be neatly bundled using only Velcro wraps. Bundle cables separately for identification purposes when applicable.

5. Comply with manufacturer's recommended bundling practices for installation. Ensure that excess pressure is not placed on the cable at any point that may result in the compression or deformation of the cable jacket and internal pair/conductor geometry.

6. Cables shall not be scrapped, dented or otherwise damaged before, during or after installation. All damaged cabling shall be replaced at no extra cost to the Owner.

7. Ensure that all cables are of sufficient length to allow for slack, vertical runs, wastage, connectorization and future moves.

3.2 CABLE ROUTING

1. Make all necessary adjustments to cable route(s)/pathway(s) to accommodate architectural, structural, mechanical and/or electrical conditions.

2. All pathways shall be parallel to building lines. If it is necessary to route cables otherwise to accommodate cable length written permission shall be obtained from the Technology Systems Consultant prior to installation.

3. Any deviation from cable routing shown on drawings (where shown) shall be approved in writing by the Technology Systems Consultant prior to installation and shall be documented on record drawings.

3.3 BEND RADIUS

1. Do not kink or exceed the cable minimum bend radius for all cabling. For all copper cabling maintain a minimum of four (4) times cable diameter as bend radii if the manufacturer specifies no bend radius.

2. Where there is the potential for excess stress on a cable(s) when pulling through conduit systems, apply a non-corrosive quick drying lubricant to the cable to facilitate pulling.

3. Completely remove all cable lubricant from cable jacket as cable exits the conduit system prior to termination and labelling.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1. Comply with Section 27 00 03 – General Specifications and Requirements for Communications.

1.2 OUTLET LOCATIONS

1. Horizontal cable outlets may be relocated prior to installation from the location shown on the drawings to a maximum distance of 3.05 m (10'-0") without adjustment to the contract price.

PART 2 - PRODUCTS

2.1 KEYSTONE STYLE UTP TERMINATION MODULES (OUTLET)

1. All keystone style UTP termination modules shall have the following minimum performance characteristics:

Modular jack current rating	1.5 Amperes maximum
Modular jack durability	1,000 mating cycles
Modular jack contact pressure	100 grams minimum per contact
Dielectric voltage strength	1,000 V RMS at 60Hz for 1 minute
Insulation resistance	200 MΩ minimum
Contact resistance	1 MΩ per contact
IDC termination connectors resistance	100 MΩ between clips

2. The contact material of the termination module shall be phosphor bronze with 50 micro-inches of gold over nickel.

3. Keystone style UTP termination modules shall be of the same category as the UTP cabling to ensure that manufacturer end to end warranties can be attained.

4. UTP cables shall be terminated with keystone style modules as listed below:

Specified Product:

	Cat.	Colour	Part No.	System
Belden	6A		AX102288	Data

2.2 WORKSTATION FACEPLATES AND ADAPTERS

1. Workstation outlets shall be supplied and installed for all terminations at the workstation end and as further specified below to suit the application.

2. The Communications Contractor shall confirm colour of outlets prior to placing order.

3. Workstation outlets shall be manufactured by the end to end solution manufacturer when available.

4. Wall Faceplates

    1. Wall faceplates shall be installed for all wall outlets, floor or raceway outlets and shall consist of a minimum of two (2) ports.

    2. Each outlet shall be installed with the specified termination modules or a blank insert. No openings shall remain exposed.

Specified Product:

	No. of Ports	Part No.	Style:
Belden	3-port	AX102661	Keystone

PART 3 - EXECUTION

3.1 TERMINATION REQUIREMENTS

1. All cabling shall be terminated using EIA/TIA 568A configuration.

3.2 WORKSTATION OUTLETS

1. Install all workstation outlets level and flush to wall surface.
2. Provide a final installation that is clean of all fingerprints and dirt complete with identification labelling as per these specifications.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1. Comply with Section 27 00 03 – General Specifications and Requirements for Communications.

1.2 GENERAL

1. The Communications Contractor shall supply and install all patch cords at both ends unless otherwise noted.
2. Patch cords shall be of the same manufacturer, quality and category to provide a complete end to end solution which shall be warranted by the selected manufacturer.
3. Supply and install two (2) patch cords for every horizontal cable installed. (Only one (1) patch cord at patch panel end for voice cabling required).

1.3 PATCH CORDS

1. All patch cords used shall be 8 position 4 pair T568A/B: T568A/B patch cords unless otherwise noted.
2. All patch cords shall be CMR (FT4) rated and stamped accordingly and shall be consistent with the category and manufacturer of the UTP cabling system that shall be warranted as part of the end to end solution.

PART 2 - PRODUCTS

2.1 UTP PATCH CORDS

1. All patch cords shall be CMR (FT4) rated and stamped accordingly.
2. Patch cords shall be manufactured of stranded conductor cable with eight (8) position four (4) pair terminations at both ends.

Specified Product:

	Cat.	Rating	Colour	Length	System	Location
Belden	6A	CMR/FT4		2'	Data	Telecom Room
Belden	6A	CMR/FT4		10'	Data	Workstation

PART 3 - EXECUTION

3.1 UTP PATCH CORDS

1. Assume all ports shall be patched.

END OF SECTION

DIVISION 28
ELECTRONIC SECURITY SYSTEM SPECIFICATIONS

PART1 - GENERAL

1.1 Refer to Section 27 00 03 (General Specifications and Requirements for Communications) for details.

PART 2 - PRODUCTS

2.1 Refer to Section 27 00 03 (General Specifications and Requirements for Communications) for details.

PART 3 – EXECUTION

3.1 Refer to Section 27 00 03 (General Specifications and Requirements for Communications) for details.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1. The following definitions may be used in this document, as well as in any project documents such as but not limited to Addenda, Contemplated Change Notices, Change Orders, and Site Instructions:

Addendum	-	Normative document used to provide additional requirements and recommendations to a published document (e.g., standards, contracts). When published, an addendum effectively becomes part of the document that it supports.
Bonding	-	The permanent joining of metallic parts to form an electrically conductive path that will ensure electrical continuity and the capacity to conduct safely any current likely to be imposed.
Bonding Conductor (BC)	-	A conductor used specifically for the purpose of bonding.
Building Entrance Facility	-	The room or space inside a building where telecommunications cables enter and leave the building.
Electronic Safety and Security Contractor	-	The successful bidder(s) responsible for the supply and installation of the Electronic Safety and Security solution as described in this Specification.
Category	-	A rating that defines the performance of cabling components and systems. Describes mechanical properties and transmission characteristics of balanced twisted-pair cabling and provides a numbered designation.
Change Notice	-	Normative document approved to provide additional requirements and recommendations that describes and authorizes the implementation of an engineering change to the product and its approved configuration documentation.
Owner	-	City of Toronto
Electronic Safety and Security Consultant	-	Gregory Larcina SPECTECH
Contemplated Change Notice	-	Normative document to provide additional requirements and recommendations that describes the implementation of an engineering change to the product and its approved configuration documentation for the purposes of pricing. This document does not authorize the implementation of a change to the

		product and its approved configuration documentation.
Cut Over	-	The live date(s) is when the Owner will occupy the space as indicated by date and/or phasing.
Contract Drawings		All Electronic Safety and Security Systems / Security, Electrical, Architectural, Mechanical and Structural Drawings issued in relation to this project including any future changes and revision of said drawings
Contract Documents		All documents including Contract Drawings issued under this project
Grounded Conductor	-	A system or circuit conductor that is intentionally grounded.
Grounding System	-	A system of hardware and wiring that provides an electrical path from a specified location to an earth ground point.
Project	-	Supply and installation of a complete Electronic Safety and Security solution to support Access Control, Intrusion Detection, Video Surveillance and Electronic Personal Protection system as described in this document.
Provide	-	Supply and install.
Shop Drawing	-	Drawings, diagrams, illustrations, schedules, performance charts, and other data prepared by the contractor which illustrate how specific portions of the work shall be installed. This includes but not limited to point-to-point high level integration diagram, riser diagram, termination diagram, panel layout, door types and product data sheet.

2. The following abbreviations may be used in this document:

A	-	Ampere
A/E	-	Architect or Engineer
ac	-	Alternating current
AFF	-	Above Finished Floor
AME	-	Architectural, Mechanical, Electrical
AN	-	Access Node
ANSI	-	American National Standards Institute
AP	-	Access Point
ASCII	-	American Standard Code for Information Interchange
ASTM	-	American Society for Testing and Materials
ATD	-	Asynchronous Time Division
AWG	-	American Wire Gauge
b/s	-	Bit per Second

BAS	-	Building Automation System
BC	-	Bonding Conductor
BIC	-	Building Industry Consultant
BICSI®	-	Building Industry Consulting Service International
bit	-	Binary Digit
c/w	-	Complete With
CA	-	Cable
CAD	-	Computer Aided Design
CATV	-	Community Antenna Television (Cable Television)
CCN	-	Contemplated Change Notice
CCTV	-	Closed Circuit Television
CD	-	Compact Disc
CD	-	Change Directive (same as Change Notice and Change Order)
CEC	-	Canadian Electrical Code
cm	-	Centimetre
CMP	-	Communications Plenum
CMR	-	Communications Riser
CN	-	Change Notice (same as Change Directive and Change Order)
CO	-	Change Order (same as Change Notice and Change Directive)
coax	-	Coaxial Cable
CP	-	Consolidation Point
CPU	-	Central Processing Unit
CSA	-	Canadian Standards Institute
Cu	-	Copper
dB	-	Decibel
dB/km	-	Decibel per Kilometre
demarc	-	Demarcation Point
e/w	-	Equipped With
EF	-	Entrance Facility
EIA	-	Electronics Industry Alliance
ELFEXT	-	Equal Level Far-End Crosstalk
e-mail	-	Electronic Mail
ER	-	Equipment Room
ESD	-	Electrostatic Discharge
FC	-	Fibre Connector
FCC	-	Federal Communications Commission
FDDI	-	Fibre Distributed Data Interface
FEXT	-	Far-End Crosstalk
FIPS	-	*Federal Information Processing Standards*
ft.	-	Foot / Feet
FT 1 / FT 3	-	Fractional T 1 / Fractional T 3
ft2	-	Square Foot / Feet
G	-	Giga
Gb	-	Gigabit
GB	-	Gigabyte
Gb/s	-	Gigabit per Second
GC	-	General Contractor
GHz	-	Gigahertz
Hz	-	Hertz
I	-	Current
IC	-	Intermediate Closet
IC	-	Intermediate Cross-connect

IDP	-	Intrusion Detection Panel
ID	-	Identification
ID	-	Inside Diameter
IEEE®	-	Institute of Electrical and Electronics Engineers, Inc. ®
IG	-	Isolated Ground
in	-	Inch
in2	-	Square Inch
ISO	-	International Organization for Standardization
IT	-	Information Technology
kb	-	Kilobit
kB	-	Kilobyte
kg	-	Kilogram
km	-	Kilometre
kV	-	Kilovolt
kVA	-	Kilovoltampere
LAN	-	Local Area Network
laser	-	Light Amplification by Stimulated Emission of Radiation
lb.	-	Pound
LED	-	Light Emitting Diode
LO	-	Laser Optimized
m	-	Metre
m2	-	Square Metre
mA	-	Milliampere
MAC	-	Move, Add, or Change
MAN	-	Metropolitan Area Network
Mb	-	Megabit
MB	-	Megabyte
Mb/s	-	Megabit per Second
MB/s	-	Megabyte per Second
MC	-	Main Cross-connect
MGB	-	Main Grounding Busbar
MHz	-	Megahertz
mi	-	Mile
min	-	Minute
Misc.	-	Miscellaneous
mm	-	Millimetre
MM	-	Multimode
ms	-	Millisecond
mW	-	Milliwatt
MW	-	Megawatt
NAS	-	Network Attached Storage
NCTA	-	National Cable Television Association
NVR	-	Network Video Recorder
NIC	-	Network Interface Card
OD	-	Outside Diameter
OEM	-	Original Equipment Manufacturer
OF	-	Optical Fibre
OSP	-	Outside Plant
PBX	-	Private Branch Exchange
PP	-	Patch Panel
PVC	-	Polyvinyl Chloride
QoS	-	Quality of Service

Qty	-	Quantity
RCDD®	-	Registered Communications Distribution Designer
RF	-	Radio Frequency
RFI	-	Radio Frequency Interference
RJ	-	Registered Jack
RU	-	Rack Unit (1.75″)
SC	-	Single Fibre Coupling Optical Fibre Connector
SCC	-	Standards Council of Canada
SI	-	International System of Units (Le Système International d'Unités)
SM	-	Singlemode
SNMP	-	Simple Network Management Protocol
STP	-	Shielded Twisted Pair
STP-A	-	Shielded Twisted Pair A
T 1	-	Trunk Level 1
TBB	-	Telecommunications Bonding Backbone
TC	-	Telecommunications Closet
TIA	-	Telecommunications Industry Association
TMGB	-	Telecommunications Main Grounding Busbar
TP	-	Twisted Pair
TR	-	Telecommunications Room
TS	-	Technical Standard
TV	-	Television
U	-	(When preceded by a numeral) Rack Unit (equal to 1.75″)
UD	-	Underfloor Duct
UL®	-	Underwriters Laboratories Inc.®
ULC	-	Underwriters Laboratories of Canada
UPC	-	Universal Product Code
UPS	-	Uninterruptible Power Supply
UTP	-	Unshielded Twisted Pair
V	-	Volt
VA	-	Volt-Ampere
VLAN	-	Virtual Local Area Network
VoIP	-	Voice over Internet Protocol
W	-	Watt
WAN	-	Wide Area Network
WAP	-	Wireless Application Protocol
WAP	-	Wireless Access Point
WHMIS	-	Workplace Hazardous Materials Information System
WS	-	Workstation
x	-	Mathematical Operation (Multiplication)
X	-	Cross-connect

Part 2 PRODUCT

2.1 Not applicable to this Section.

Part 3 EXECUTION

3.1 Not applicable to this Section.

END OF SECTION

PART1 - GENERAL

1.1 Refer to Section 27 00 07 (Codes and Standards for Electronic Security System) for details.

PART 2 - PRODUCTS

2.1 Refer to Section 27 00 07 (Codes and Standards for Electronic Security System) for details.

PART 3 – EXECUTION

3.1 Refer to Section 27 00 07 (Codes and Standards for Electronic Security System) for details.

END OF SECTION

PART1 - GENERAL

1.1 Refer to Section 27 00 09.10 (Scope of Work for Communications) for details.

PART 2 - PRODUCTS

2.1 Refer to Section 27 00 09.10 (Scope of Work for Communications) for details.

PART 3 – EXECUTION

3.1 Refer to Section 27 00 09.10 (Scope of Work for Communications) for details.

1. Refer to item 5 under 3.1 for Security scope.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1.1.1 Conform to Section 28 00 03 – General Specifications and Requirements for Electronic Safety and Security.

1.2 Shop Drawings

1.2.1 Provide 1 PDF format of manufacturer prepared shop drawings identifying complete technical specifications for each product being supplied as part of the end-to-end solution including fire stopping, pathways and other miscellaneous products.

1.2.2 Shop drawings shall be stamped and signed "For Review" complete with date submitted.

1.2.3 Manufacturers shop drawings showing various model or styles shall be labelled with identification arrows and or highlights showing which items are being proposed. Arrows and or highlights shall be reproducible through standard photocopying.

1.2.4 Shop drawings shall be approved by the Electronic Safety and Security Consultant prior to starting installation and the Electronic Safety and Security Contractor will be responsible for the cost of replacing of all installed product not approved.

1.2.5 Approved shop drawings shall be included in the Project Manual for this project.

1.3 Project Documentation

1.3.1 The Electronic Safety and Security Contractor shall provide hand marked record drawings showing all cable numbers on floor plans, rack elevations, backboard layouts and cable routing at the completion of the project. Drawings shall include all architectural and project changes. Provide within ten (10) days of substantial completion of the project two (2) hard copies for review and approval by the Electronic Safety and Security Consultant.

1.3.2 The Electronic Safety and Security Contractor shall include an allowance of $ 1,500 to be paid to the Electronic Safety and Security Consultant for the preparation of final record drawings and coordination of record documentation. The Electronic Safety and Security Consultant will coordinate and provide final delivery of record documentation to the Owner upon receipt of payment from the Electronic Safety and Security Contractor.

1.3.3 Prepare a complete Verification report for each door or security device, complete with the technician's signature and date

1.3.4 At the completion of the project be prepared to submit 1 copy of a project manual in PDF format to the Electronic Safety and Security Consultants for review and approval. This project manual shall include:

.1 Contractor's Name, contact information and lead installer/foreman's contact info

.2 Letter detailing, total cost of project (including changes), square footage, project highlights, Architect/Interior Designer and Owner name and contact information.

.3 Final bill of materials

.4 Approved shop drawings

.5 WHIMS data sheets on all applicable materials including fire stopping

.6 Maintenance and/or operation manuals for all equipment

.7 Connectivity database

.8 Test results

.9 Record drawings

.10 Letter of 1 year installation warranty

.11 Manufacturer's Certification and warranty documentation

1.3.5 Upon written approval from the Electronic Safety and Security Consultant prepare (3) additional project manuals for distribution to the Owner in PDF or hardcopy format as requested.

1.3.6 The Electronic Safety and Security Contractor shall prepare a separate Connectivity Database in Excel spreadsheet format.

1.4 Site Documentation

1.4.1 The Electronic Safety and Security Contractor shall be responsible for maintaining a complete set of record marked up drawings on site for the Electronic Safety and Security Consultants review at all times. Drawings shall be up to date with all architectural and project changes.

1.4.2 Maintain a log of date, time, and reason for any delays in performing the installation. Details shall include names, conditions, and specific reason for delay.

1.4.3 The Electronic Safety and Security Contractor shall prepare a separate Connectivity Database in Excel spreadsheet format.

1.4.4 Final documentation not provided within 30 days of project completion and with reasonable notification may result in the commissioning of another agent to prepare such documents. Costs for this work will be deducted from all Holdback amounts available to the Electronic Safety and Security Contractor.

Part 2 PRODUCT

2.1 DOCUMENTATION REQUIREMENTS

2.1.1 The following items shall be delivered as scheduled after project award:

Delivery Item	Delivery Schedule	Presentation

Shop Drawings (PDF)	10 days after project award	Email/ Electronic PDF
Monthly Draw Breakdown (PDF)		

2.1.2 The following items shall be kept up to date during project construction.

Delivery Item	Delivery Schedule	Presentation
Continuously Updated Drawings	During construction on-site	Electronic PDF

2.1.3 The following items shall be delivered after project completion (in a single PDF):

Delivery Item	Delivery Schedule	Presentation
Contractor's Information	10 Days after Cutover	Electronic PDF
Project Details	10 Days after Cutover	Electronic PDF
Final Bill of Materials	10 Days after Cutover	Electronic PDF
Approved Shop Drawings	10 Days after Cutover	Electronic PDF
WHIMS Data Sheets	10 Days after Cutover	Electronic PDF
Maintenance / operation manuals	10 Days after Cutover	Electronic PDF
Verification Report	10 Days after Cutover	Electronic PDF
Record Drawings	10 Days after Cutover	Electronic PDF
Contractor's Warranty	10 Days after Cutover	Electronic PDF
Manufacturer Warranty	10 Days after Cutover	Electronic PDF
Access Control Schedule: • Door Number • Level (Floor) • Manufacture • Software Version • Door Module Model • Card Reader Make and Model • Request to Exit Sensor Make and Model • Request to Exit Button Make and Model • Door Contact Make and Model • Electric Strike Make and Model • IP Address • Subnet • Gateway • Primary DNS • Secondary DNS • NTP • Cable ID (Label) • Switch • Switch Port • Comments on Location	10 Days after Cutover	Excel Format

Part 3 EXECUTION

3.1 Not applicable to this Section.

END OF SECTION

PART1 - GENERAL

1.1 Refer to Section 27 00 13 (Fire Stopping for Electronic Security System) for details.

PART 2 - PRODUCTS

2.1 Refer to Section 27 00 13 (Fire Stopping for Electronic Security System) for details.

PART 3 – EXECUTION

3.1 Refer to Section 27 00 13 (Fire Stopping for Electronic Security System) for details.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1. Conform to Section 27 00 03 – General Specifications and Requirements for Electronic Safety and Security.

1.2 GENERAL

1. Access control cabling shall be installed in conduit indicated on drawings and as per Section 28 05 28 of this specification.
2. Ensure that all cables are sufficiently long to allow for slack, vertical runs, wastage, connectorization and future moves.

PART 2 - PRODUCTS

2.1 MULTI-CONDUCTOR COPPER CABLING

1. All access control cabling shall be stranded, twisted, overall shield copper conductor, CSA certified and stamped with CMR/FT6 rating accordingly.
2. All multi-conductor copper cables shall meet the minimum requirements identified below.

Conductor	Rating	AWG	Device
6	CMR/FT6	22 Shielded	Card Reader
4	CMR/FT6	22	Door Contact
4	CMR/FT6	22	Request to Exit Sensor
2	CMR/FT6	22	Request to Exit Push Button
2	CMR/FT6	18	Electric Strike

PART 3 - EXECUTION

3.1 ACCESS CONTROL CABLING

1. Cabling shall be run in conduit and shall be concealed in finished areas.
2. Cabling shall be terminated as per manufacturer's guidelines. Remove only enough cable jacket to perform termination.
3. Comply with manufacturer's recommended bundling practices for installation. Ensure that excess pressure is not placed on the cable at any point that may result in the compression or deformation of the cable jacket and internal pair/conductor geometry.
4. Cables shall not be scrapped, dented, or otherwise damaged before, during or after installation. All damaged cabling shall be replaced at no extra cost to the Owner.
5. The splicing of any access control cables is not permitted.
6. After installation, and before termination, all wiring and cabling shall be checked and tested to ensure there are no grounds, opens, or shorts on any conductors or shields. A V.O.M. shall be utilized to accomplish these tests and a reading of greater than 20 Megohms shall be required to successfully complete the test.

7. Ensure that all cables are of sufficient length to allow for slack, vertical runs, wastage, and connectorization.

END OF SECTION

PART1 - GENERAL

1.1 Refer to Section 27 05 26 (Grounding and Bonding for Communications) for details.

PART 2 - PRODUCTS

2.1 Refer to Section 27 05 26 (Grounding and Bonding for Communications) for details.

PART 3 - EXECUTION

3.1 Refer to Section 27 05 26 (Grounding and Bonding for Communications) for details.

END OF SECTION

PART1 - GENERAL

1.1 Refer to Section 27 05 28 (Pathways for Communications) for details.

PART 2 - PRODUCTS

2.1 Refer to Section 27 05 28 (Pathways for Communications) for details.

PART 3 – EXECUTION

3.1 Refer to Section 27 05 28 (Pathways for Communications) for details.

END OF SECTION

PART1 - GENERAL

1.1 Refer to Section 27 05 53 (Identification for Communications) for details.

PART 2 - PRODUCTS

2.1 Refer to Section 27 05 53 (Identification for Communications) for details.

PART 3 – EXECUTION

3.1 Refer to Section 27 05 53 (Identification for Communications) for details.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1. Conform to Section 28 00 03 – General Specifications and Requirements for Electronic Safety and Security.

1.2 WARRANTY AND SERVICE AGREEMENT

1. All equipment, materials, and labour shall be guaranteed for a period of 1 year from the date of final acceptance by the Owner.
2. Provide any software maintenance updates or upgrades at no additional cost to the Owner for this period.
3. Perform two (2) scheduled preventative maintenance site visits per year during the warranty period.
4. Response Times - Normal business hours shall be 8 AM to 5 PM Monday through Friday. Calls for service before noon shall be responded to on-site before the end of the day. Calls after noon shall be responded to on-site by noon the following business day.
5. Provide extra costs for time outside of normal business hours if the Owner requires emergency service.
6. Submit an all-inclusive Annual Maintenance Agreement cost for years 2, 3, 4 and 5, including two (2) preventative maintenance sites visits per year.
7. Submit normal and after-hours labour costs and typical costs for equipment for items not covered under the Warranty, like: Acts of God, vandalism, misuse.

PART 2 - PRODUCTS

2.1 Not applicable to this Section.

PART 3 - EXECUTION

3.1 GENERAL

1. The Electronic Safety and Security Consultant reserves the right to witness test any or all of the systems as required. The Electronic Safety and Security Contractor will provide (3) day notice prior to starting testing in any particular phase of the project.

1. The Electronic Safety and Security Contractor shall arrange and include all time required to tour site with manufacturer in order to warranty the systems. This includes for additional visits if required.

2. The Electronic Safety and Security Engineer's Representative shall make general reviews at the job site and shall review the following for configuration:

   .1 Quality of construction

   .2 Adherence to design requirements

.3 Conformance with shop drawings and submittal information.

3.2 COMMISSIONING

.1 The Electronic Safety and Security Contractor shall identify all components, functions and systems that shall be commissioned.

.2 The Electronic Safety and Security Contractor shall develop device checklists, functional test forms and system integration test forms that shall be executed by the Electronic Safety and Security Contractor.

.3 Each device checklist shall include but not limited to:

a. Unique identifier of each device and component of the respective system
b. Location of device
c. Name of commissioning agent
d. Name of witness
e. Date of commissioning
f. For each device, all function and performance requirements indicated in the relative system specifications sections of this document, all function and performance requirements indicated on all associated drawings, all industry standard tests, all manufacturer recommended tests, all test that are required to confirm that the respective device is in proper working order.
g. Confirmation of device tests performed
h. Confirmation of tests passed or failed and related comment

.4 Each functional test form shall include but not limited to:

a. Identification of system under test
b. Location of system
c. Name of commissioning agent
d. Name of witness
e. Date of commissioning
f. For each system, all function and performance requirements indicated in the relative system specifications sections of this document, all functions indicated on all associated drawings, all industry standard functional tests, all manufacturer recommended functional tests and all functional tests that are required to confirm that the respective system is in proper working order.
g. Confirmation of functional tests performed
h. Confirmation of tests passed or failed and related comment

.5 Systems Integration Functional Test Forms

a. Each system integration test form shall include but not limited to:
b. Identification of systems under test
c. Location of systems
d. Name of commissioning agent
e. Name of witness
f. Date of commissioning
g. All integrated function and performance requirements that are indicated in the electronic safety and security system integration specifications section of this document, all integrated functions indicated on all associated drawings, all industry standard integration functional tests, all manufacturer recommended integrated functional tests and all integrated functional tests that are required to confirm that the respective systems are integrated and are in proper working order.

h. Confirmation of integrated functional tests performed
i. Confirmation of tests passed or failed and related comment

.6 The Electronic Safety and Security Contractor shall forward the device checklists, functional test forms and systems integration test forms to the Electronic Safety and Security Consultant for review and approval prior to commencing commissioning.

.7 Pre-Start-up Test

a. The Electronic Safety and Security Contractor shall perform prestart-up tests to verify that the devices and systems that are to be commissioned are powered, calibrated, operational, and ready for device and functional testing.

.8 Perform Device Tests

a. The Electronic Safety and Security Contractor shall perform device tests for all devices in accordance with the device checklists.

.9 Perform Functional Tests

a. The Electronic Safety and Security Contractor shall perform functional tests for all devices and systems in accordance with the functional test forms.

.10 Perform System Integration Tests

a. The Electronic Safety and Security Contractor shall perform system integration functional tests for all devices and systems in accordance with the system integration functional test forms.

.11 Perform Retests as Necessary

a. For all failed tests, the Electronic Safety and Security Contractor shall make all necessary repairs and perform retests. Failure of the integrated test may require the retest of one or more individual tests. Repairs and retests shall be by the Electronic Safety and Security Contractor until all tests are passed.

.12 Turnover

a. The Electronic Safety and Security Contractor shall prepare a comprehensive commissioning report that include but not limited to completed device checklists, completed functional test forms, completed systems integration functional test forms with measured data. The commissioning report shall be submitted along with system operation and maintenance manuals for review and approval by the Electronic Safety and Security Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1. Conform to Section 28 00 03 – General Specifications and Requirements for Electronic Safety and Security.

1.2 PURPOSE

1. The buildings and facilities Access Control System primary function is to protect the assets. The contents of this document are critical and are considered confidential. This information shall not be disclosed to anyone other than authorized personnel.

1.3 GENERAL

1. All equipment and materials used shall be standard components that are regularly manufactured and used in the manufacturer's system.
2. All systems and components shall have been thoroughly tested and proven in actual use.
3. All systems and components shall be provided with the availability of a toll-free (U.S. and/or Canada), 24-hour technical assistance program (TAP) from the manufacturer. The TAP shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge for as long as the product is installed.
4. Pre-existing access control system shall be confirmed on site to have capacity for new and re-located access control devices as per drawings and specifications.
5. All new and relocated access control devices shall be confirmed to be compatible with pre-existing access control prior to purchase.
6. The Access Control system shall allow for modular expansion of 15% on day one (1) of a fully operational system.
7. All systems and components shall be provided with a one-day turnaround repair express and 24-hour parts replacement. The repair and parts express shall be guaranteed by the manufacturer on warranty and non-warranty items.
8. The access control system shall be an inter-connected group of components consisting of but not limited to the following devices:
   - .1 Controllers
   - .2 Communication devices
   - .3 Access control software
   - .4 Readers
   - .5 Fobs or cards
   - .6 Door locks
   - .7 Lock power supplies
   - .8 Personal computers
   - .9 Servers
9. Building Integration

.1 The system shall be structured to provide a continually expandable growth path from the capabilities and features specified within this document without the necessity of exchanging previously installed controllers or software.

10. Communication Modes

.1 The software application modules shall be designed to communicate to the access control units using one or a combination of the following connection modes:

.2 Network (TCP/IP)

.3 Internet

PART 2 - PRODUCTS

2.1 MANUFACTURES

1. Acceptable Manufactures: HID and Bosch.

2.2 ACCESS CONTROL - DOOR CONTROLLERS AND PANELS

1. Door controllers are existing on site and confirmed by City of Toronto have space for expansion for new and relocated access control system.
2. Location of existing door controller panels shall be coordinated on site prior to bid.

2.3 PROXIMITY CARD READERS

1. The proximity card reader shall be a black in colour.
2. The reader shall be combo style suitable for mounting on standard 1104 electrical box or mullion as indicated on drawings.
3. The reader shall be compatible with HID 125 kHz cards.

Specified Product:

	Model No.	Details
HID	Signo 40	Wall Locations

2.4 REQUEST TO EXIT DETECTOR

1. Minimum Features/Specifications

.1 Detector Type: Passive infrared

.2 Filter Technology: Digital Signal Processing (DSP)

.3 Detector Lens: Curtain-type Fresnel lens

.4 Detection Range:

a. Narrow Targeting Area: 3 m (10 ft)
b. Whole Body: 6 m (20 ft)

.5 Piezo Buzzer: 90 dB at 28 VDC, 5-28 VDC,

.6 Main Relay Contacts: SPDT, 1A max @ 30 VDC max

.7 Main Relay Timer: Adjustable, 0.5 to 60 seconds

.8 Main Relay Recycle Timer: Fixed, 0.75 seconds off

.9 Lock Control Relay: -state relay, N.C.,2A max @ 30 VDC, timed at 2 seconds fixed

.10 Tamper Switch: N.C., 100 mA max @ 30 VDC max

.11 Indicator Light: Red/Green LED

.12 Mounting: Optional back plate for mounting on a standard single-gang electrical box

.13 REX colour to be confirmed before purchase and shall be coordinated with the Interior Designer and Client.

Specified Product:

	Model No.	Details
Bosch	DS150i	REX Detector for Single or double door

2.5 ELECTRIC LOCKS

1. All electric locks provided by others.
2. Electronic locking devices shall have a separate power supply to support the locks specified below. The unit shall incorporate integral battery charging capabilities and a fused line voltage input for a minimum of eight (8) individual locks. All power supplies shall be equipped with optional battery pack for up to 48 hours. The unit shall be equipped with a fire alarm system interface as required.

2.6 PERIPHERAL DEVICES

1. Door Contacts (Steel)
   - .1 1″ dia. contact for use in steel doors.
   - .2 Flush or surface mount as required
   - .3 Self-lock mounting
   - .4 Rugged Construction
2. Door Contacts (Wood)
   - .1 3/8″ dia. contact for use in wood doors.
   - .2 Flush or surface mount as required
   - .3 "Wings" protect contact reed from being crushed from swelling wood
   - .4 Installed quickly in over drilled holes
   - .5 Superior false alarm immunity
3. Door Contacts (Overhead Door)
   - .1 Miniature and low-profile design
   - .2 Stainless steel armoured cable for added security and reliability
   - .3 Aluminium bar stock to resist corrosion in harsh environments
   - .4 Floor or track mount as required

PART 3 - EXECUTION

3.1 COORDINATION

1. The Electronic Security Systems Contractor (ESSC) shall assume control and accountability for furnishing and installing all electronic security systems as hereafter specified.
2. The ESSC shall be responsible for the systems specified in this Section, including coordination with related trades.
3. The ESSC shall coordinate all work and submittal details with the electronic door hardware supplier to ensure proper sizing of control equipment and shall be responsible for proper sizing of interface equipment (i.e., relays, contact ratings, etc.) to eliminate interface problems.
4. The ESSC shall coordinate with Owner's security group for all programming, commissioning, and testing of new and relocated access control door devices.
5. Related work required to be provided:
   - .1 Door Hardware/ Electronic Locks coordination for system operation and interface
   - .2 Electrical Works
   - .3 Control Work and/or annunciation
   - .4 All 120 Volt wiring and connections from power panels to terminal strips in electronic low-voltage panels, power supplies and devices
   - .5 All raceway, conduit to the device(s), including all back boxes and pull strings and the installation of all special back boxes.

3.2 CONTROLLER AND PERIPHERAL DEVICES

1. Provide and install access control panels/enclosures as required to house and protect all controllers.
2. All controllers and peripheral devices shall be installed and configured in accordance with manufacturer's installation instructions and recommendations, as per the Owner's requirements and as per contract drawings and specifications.
3. Coordinate the exact mount location of peripheral device devices with the electrical contractor to ensure that all conduits and back boxes are installed in the optimal locations.
4. Coordinate exact mounting locations of all controllers on site with security Engineer's Representative and client.
5. Supply and install all peripheral devices as indicated on contract drawings and documents.
6. Refer to Architectural Door and Door Hardware Schedules and ensure that each peripheral device is coordinated with its respective door and door hardware.
7. All peripheral devices shall be compatible with the access control system.
8. Submit shop drawings of all peripheral devices to the Security Engineer's Representative for approval prior to procurement and installation.
9. Allow for "needs assessment sessions" with client to determine the exact mode/s of operation of each peripheral device.
10. Configure each peripheral device and each controller to suit the client's requirements.

3.3 POWER SUPPLY

1. Supply and install power supplies as required for a fully functional access control system. Power supplies shall include but not limited to all controller power supplies, all electric lock power supplies and all peripheral device power supplies.
2. All power supplies shall be installed to manufactures recommendations and as required to furnish a fully functional access control system.
3. All power supplies shall be sized to facilitate connection of each electrified lock and each powered device to separately fused power output.

3.4 ELECTRIC LOCKS

1. All electric locks shall be supplied and installed by the door hardware contractor.
2. Electrified locks shall include but not limited to:
   - .1 Electric strikes
   - .2 Magnetic locks/Maglocks
   - .3 Electric mortise locks
   - .4 Electric latch retraction
3. Coordinate with the door hardware contractor and electrical contractor, make all wire connections to all electric locks as required for a complete access control system.
4. Supply and install wiring as required for complete operation all access control devices and systems.
5. Include for all costs and work associated with acquiring permits for all magnetic locks.

3.5 INSTALLATION

1. Install all system components and appurtenances in accordance with the respective manufacturer's specifications, referenced practices, guidelines, and applicable codes. Furnish all necessary interconnections, services, and adjustments required for a complete and operable system as specified. Control signal, communications, and data transmission line grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.
2. Install the wiring system and integrate the system as indicated in this specification. All wiring is to be installed in dedicated conduit throughout. Wiring shall not be pulled into conduits or placed in raceways, compartments, outlet boxes, junction boxes, or similar fittings with other building wiring.
3. All low voltage wiring outside the control console, cabinets, boxes, and similar enclosures, shall be plenum rated where required by code.
4. All wiring conductors shall be individually numbered and each cable or wiring group being extended from a panel or cabinet to a building mounted device shall be identified with the name and number of the particular device.
5. All exposed wiring inside and outside the control console, cabinets, boxes, and similar enclosures, shall be dressed down neatly and secured with wiring cleats or wire ties.
6. All exposed metallic flexible conduit and armored cable shall be dressed down neatly and secured with low profile, metal fasteners.

7. All cabinets, boxes, and similar enclosures containing security system components and/or cabling and which are easily accessible to employees or to the public shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible.

8. All junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamper proof screws.

9. End-of-Line resistors shall be installed at the field device location and not at the controller panel location.

10. System devices identified on building drawings are intended to generally indicate areas where such devices are to be located. Determine and coordinate the final locations of these devices on site with the electrical contractor to ensure that all conduits and associate Back boxes are located where respective devices will be installed. Be responsible for all costs resulting from failure to execute the above.

11. Riser diagrams are schematic and do not show every conduit, wire box, fitting, or other accessories. Provide such materials as necessary for a complete and functioning installation. Install in accordance with referenced codes and these specifications. Use weatherproof equipment or covers where installed in areas exposed to weather.

12. All equipment shall be mounted with sufficient clearance to meet all applicable codes and facilitate observation and testing. All equipment shall be securely fastened with appropriate fittings to ensure positive grounding and be free of ground loops.

13. Determine conductor requirements for each device in accordance with the Contract Documents and manufacturer requirements.

14. Install cable in accordance with Security System manufacturer requirements.

15. Neatly route cables parallel or perpendicular to building lines.

16. Provide J hooks and other cable support systems (spaced at regular intervals) within accessible ceiling spaces. Fasten cables to the cable support systems and provide strain relief to protect cables and ensure compliance with required cable bends.

17. Keep free-air cables a minimum of 18” from high voltage (120 VAC and above) circuits (e.g. light fixtures, wire run parallel with conduit, transformers, electric panels, etc.).

18. Run cables at least six inches from the communications cable plant, intercom wires, input/output wires, and siren wires.

19. Route wire and cable as required preventing interference and signalling contamination of both Security System cable and cable associated with other systems. Coordinate the routing of wire and cable requiring isolation from power, radio frequency (RF), telephone, etc.

20. Provide sleeves and code compliant fire proofing techniques for all penetrations of fire rated partitions, masonry walls, and slabs, where the penetrations are made by or used for installation of Security Systems.

21. Separate high voltage (120 VAC and above) cables from low voltage cables within enclosures

22. Run wire and cable continuous from device location to the final point of termination. No mid-run cable splices will be allowed.

23. Bundle and tie wire and cable with cable ties.

24. Cover exposed high voltage (120 VAC and above) power terminations within DGP's, power distribution cabinets and other security enclosures.

3.6 LABELLED FRAMES, DOOR, AND ENCLOSURES

1. In no instance shall any UL labeled door, frame or enclosure be drilled, cut, penetrated, or modified in any way.

3.7 MANUFACTURER'S FIELD SERVICES

1. Provide manufacturer's field services for final system checkout and acceptance testing as required.

3.8 PROTECTION

1. Protect installed products until completion of project.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1. The Access Control system shall be integrated on a single common IP network via respective servers; controllers and a common data switch to provide integrated functions as described in this specifications document and on Contract Drawings.
2. These "performance" specifications are to be translated into specific equipment depicting products which the Contractor proposes to use.
3. The integration of new and relocated access control devices with other existing systems including, but not limited to, CCTV, Alarm, Intercom, shall be coordinated with Owner's security group.

PART 2 PRODUCTS

1. Not applicable

PART 3 EXECUTION

3.1 INSTALLATION

1. Install system in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

1. Test in accordance with manufacturer's testing procedures.

3.3 MANUFACTURER'S FIELD SERVICES

1. Provide manufacturer's field services for final system checkout and acceptance testing as required.

3.4 PROTECTION

1. Protect installed products until completion of project.
2. Repair or replacement damaged products before Substantial Completion.

END OF SECTION