THE REGIONAL MUNICIPALITY OF YORK

CORPORATE SERVICES DEPARTMENT
PROPERTY SERVICES BRANCH

CONTRACT NO. T-19-349

Interior Renovations - 3rd Floor, Blocks A, B & D at York Region Administrative Centre

17250 Yonge Street, Newmarket

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THIS CONSTRUCTION CONTRACT NO. T-19-349 is dated _____

BETWEEN:

THE REGIONAL MUNICIPALITY OF YORK

(the "**Region**")

- and-

_____

(the "**Contractor**")

ARTICLES OF AGREEMENT

The parties agree:

Article A-1 The Work

1.1 The Contractor shall:

(a) perform the Work required by the Contract Documents for Contract No. T-9-349 for Interior Renovations on the 3rd floor, Blocks A, B and D of the York Region Administrative Centre located at 17250 Yonge Street in Newmarket; and

(b) do and fulfill everything indicated by the Contract Documents; and

(c) complete the Work within the Contract Time.

Article A-2 Contract Time

2.1 The Contractor shall complete the Work within 250 Working Days from the commencement date specified in the Region's written notice to the Contractor to commence the Work (the "**Commencement Date**"), subject to potential adjustment pursuant to GC 5 - Extension of Contract Time.

2.2 Notwithstanding the Contract Time stipulated above, the Contractor shall comply with, and meet the requirements of, the following Interim Milestone(s):

(a) achieve Substantial Performance of the Contract within 230 Working Days from the Commencement Date.

Article A-3 Contract Documents and Reference Documents

3.1 The following is a list of the Contract Documents referred to in Article A-1 - The Work and as defined in the Definitions. This list is subject to subsequent amendments in

accordance with the provisions of the Contract. Unless otherwise indicated, terms used in the Contract Documents which are defined in the Definitions shall have the meanings designated in the Definitions.

- Bid
- Articles of Agreement
- Definitions
- Abbreviations
- General Conditions of the Contract
- Supplementary Conditions
- Specifications
- Drawings
- Addenda

3.2 The following documents are provided for information purposes only and do not form part of the Contract Documents.

- Appendices
  - Appendix A – Forms
  - Appendix B - Health and Safety Guide for Construction Contractors

Article A-4 Contract Price

4.1 The quantities included in the Bid are an estimate of the Region's requirements and there is no guarantee that the full quantities of Products or work will be required or purchased. In the event that the actual quantity of any unit price item exceeds, or is less than, the estimated quantity, the Contractor shall proceed as required to complete the work of such item and payment for that item will be made at the tendered unit price based on the actual quantity of Product or work provided.

4.2 The prices contained in the Bid are not subject to change without the prior written consent of the Region. The Contractor shall not be entitled to any increases in the Contract Price, or to the prices for any of the individual items, for any reason whatsoever including, but not limited to, increases in prices due to inflation or due to the escalation of labour or material costs.

4.3 The Contract Price shall be the final sum of:

(a) the products of the actual quantities of unit price items that are incorporated in the Work, as confirmed by count and measurement by the Region, and the applicable unit prices in the Bid;

(b) the lump sum prices in the Bid for lump sum items that are incorporated in the Work; and

(c) the expended portions of any cash allowance items

subject to changes in the Contract Price resulting from Changes in the Work ordered pursuant to GC 14 - Changes in the Work.

Article A-5 Payment

5.1 Provided that the Contractor is not in default under the Contract, and subject to the provisions of the Contract, the Region shall pay the Contractor the undisputed amounts payable under Proper Invoices given to the Region in accordance with the Contract, on account of the Contract Price.

5.2 Payment shall be made in Canadian funds.

5.3 Subject to the provisions of the Contract, and in accordance with the Construction Act, the Region shall:

(a) pay to the Contractor the undisputed amounts payable under the Proper Invoices given by the Contractor to the Region in accordance with the Contract, subject to the 10% statutory holdback and a 3% maintenance security;

(b) pay the 10% basic holdback to the Contractor in accordance with the Construction Act;

(c) pay the 10% holdback for finishing work to the Contractor in accordance with the Construction Act; and

(d) subject to any deductions made by the Region in accordance with GC 72 - Maintenance Security, pay the 3% maintenance security to the Contractor upon the expiration of the warranty period and the correction of all deficiencies and warranty issues to the satisfaction of the Region (whether they have occurred during the warranty period or thereafter).

5.4 If the Contractor is a non-resident of Canada, the applicable provisions of the *Income Tax Act,* RSC 1985, c 1 shall apply.

Article A-6 Warranty Period

6.1 For the purposes of GC 37 - Warranty, the warranty period shall be 24 months from the date of Total Performance of the Contract, or such longer periods as may be specified for certain Products or work.

Article A-7 Liquidated Damages

7.1 For the purposes of GC 38 - Liquidated Damages, liquidated damages will be assessed in accordance with the following:

(a) $500 per Day for each Day that Substantial Performance of the Contract is not achieved beyond the 230 Working Days referred to in Article 2.2(a); and

(b) $500 per Day for each Day that the Work is not completed beyond the Contract Time.

7.2 The liquidated damages referred to above shall accrue concurrently in the event that the work required under the Interim Milestone(s) is not completed before the Contract Time has expired.

Article A-8 Notices

8.1 Any notices, requests, demands or other communications (a "**Notice**") required to be given or served under this Contract shall be in writing and delivered personally, electronically, by courier or prepaid registered mail, addressed to the recipient at the address set out below. Service of Notice is effective on the date of personal delivery, on the next Business Day following the date of electronic or courier delivery, provided that reasonable steps are taken to ensure receipt, and on the third Business Day following the date of prepaid registered mail delivery.

The Region

Property Services Branch, 145 Harry Walker Parkway North, Newmarket, ON, L3Y 7B3, Attention: Victor Chau

Victor.chau@york.ca
(e-mail address)

The Contractor

(delivery address)

(e-mail address)

The Consultant

G. Bruce Stratton Architects
(name)

225 Richmond Street, Toronto, ON, M5V 1W2
(delivery address)

bruces@strattonarchitects.com
(e-mail address)

8.2 An address for a party may be changed by giving Notice to the other parties in accordance with this Article.

8.3 Any notices required to be given under the Construction Act, including without limitation notices of non-payment, shall be given in accordance with the requirements for Notices prescribed by this Article A-8 - Notices. Proper Invoices shall be given in accordance with the requirements of GC 18.2 - Submission of a Proper Invoice.

Article A-9 Rights and Remedies

9.1 The duties and obligations imposed by the Contract and the rights and remedies available thereunder shall be in addition to, and not a limitation of, any duties, obligations, rights and remedies otherwise imposed or available by law.

Article A-10 Waiver

10.1 No action or failure to act by the Region or the Consultant is a waiver of any right or duty afforded under the Contract or law, nor shall any such action or failure to act constitute an approval of, or acquiescence in, any breach, except as may be specifically agreed to in writing.

Article A-11 Time of the Essence

11.1 Time is of the essence in this Contract.

Article A-12 Governing Law

12.1 This Contract is governed by the laws of Ontario and the applicable laws of Canada.

Article A-13 Language of the Contract

13.1 This Contract is drawn in English at the request of all parties hereto; ce marché est rédigé en anglais à la demande de toutes les parties.

Article A-14 Successors and Assigns

14.1 This Contract is enforceable against the parties, their heirs, executors, administrators, successors and permitted assigns.

Article A-15 Severability

15.1 Each provision of this Contract shall be valid and enforceable to the fullest extent permitted by law. Any provision of this Contract, or part thereof, determined to be invalid or unenforceable by a court of competent jurisdiction shall be ineffective to the extent of such determination without affecting the validity or enforceability of the remaining provisions, in whole or in part, of this Contract.

Article A-16 Entire Agreement

16.1 This Contract represents the entire agreement between the Contractor and the Region and supersedes any previous agreements, negotiations and understandings. There are

no agreements, representations, warranties, terms, conditions or commitments regarding the subject matter of this agreement except as expressed in this Contract.

Article A-17 MFIPPA

17.1 The parties acknowledge that the information collected, used or disclosed under this Contract is subject to the *Municipal Freedom of Information and Protection of Privacy Act,* RSO 1990, c M.56 ("**MFIPPA**") and all applicable federal and provincial legislation, regulations and standards relating to the collection, use and disclosure of information.

Article A-18 Construction and Interpretation

18.1 Whenever used in this Contract, the word "shall" shall be construed as mandatory and the word "may" shall be construed as permissive.

18.2 The titles in this Contract have been inserted for convenience and are for reference only and in no way define, limit or enlarge the scope or meaning of any provision of this Contract.

18.3 Where the context permits or requires, the singular shall include the plural, the plural shall include the singular, the masculine shall include the feminine and the feminine shall include the masculine.

Article A-19 Corporate Capacity

19.1 The Contractor represents that:

(a) it is a corporation legally permitted to work within the Province of Ontario;

(b) it has full corporate power and capacity to enter into this Contract in accordance with the laws of the Province of Ontario; and

(c) all necessary corporate action has been taken by the Contractor to authorize the execution and delivery of this Contract.

Article A-20 Counterparts

20.1 This Contract may be executed in counterparts, each of which shall be deemed to be an original, and all of which such counterparts, together, shall constitute one and the same contract. Counterparts may be executed in original or electronic form, and the parties shall accept any signatures received in electronic form as if they were original signatures of the parties.

This Contract is effective on the date stated in the introductory clause.

THE REGIONAL MUNICIPALITY OF YORK

Name:
Title:

Name:
Title:

[CONTRACTOR]

Name:
Title:

Name:
Title:

I/We have authority to bind the corporation

DEFINITIONS

The following definitions shall apply to all Contract Documents:

Authorities and **Authorities Having Jurisdiction** means those authorities having jurisdiction under law over the Work or parts thereof.

Bid means the Contractor's response to the Request for Tender for this Contract.

Business Day means any Day except Saturdays, Sundays and statutory holidays in the Province of Ontario.

Change Order means a written amendment to the Contract signed by the Contractor and the Region stating their agreement on a Change in the Work, the method and/or amount of adjustment to the Contract Price, if any, and the extent of any adjustment to the Contract Time, including any Interim Milestones.

Changes in the Work means additions, deletions, extensions, increases, decreases or other revisions to the Work within the general scope of the Contract.

Commissioner means the Commissioner of Corporate Services for the Region or their authorized agent or representative as designated to the Contractor.

Construction Act means Ontario's *Construction Act*, RSO 1990, c. C.30, as amended or replaced from time to time.

Constructor is as defined pursuant to the *Occupational Health and Safety Act*, RSO 1990, c O.1 as amended or replaced from time to time.

Consultant means the person, firm or corporation, if any, appointed by the Region for the purposes set out in GC 3.1. In the event that a Consultant has not been appointed, all references to the Consultant in the Contract Documents shall be deemed to be to the Commissioner.

Contract means the undertaking by the parties to perform their respective duties, responsibilities and obligations as prescribed in the Contract Documents and represents the entire agreement between the parties. The Contract supersedes all prior negotiations, representations and agreements, either written or oral between the parties, except to the extent specifically referred to in the Contract. The Contract may be amended only as provided in the Contract Documents.

Contract Administrator means the person appointed by the Region as its Site representative for the purpose of administering the Contract.

Contract Documents means the documents listed in Article A-3 - Contract Documents as amended pursuant to the provisions of the Contract.

Contract Drawings means all plans, profiles, drawings, sketches or copies thereof, used or prepared for, or in connection with, the Work and are included in the Contract Documents.

Contract Price shall have the meaning prescribed in Article A-4 - Contract Price, paragraph 4.3.

Contract Time is the timeframe stipulated in Article A-2 - Contract Time of the Articles of Agreement for completion of the Work.

Contractor means the person, firm or corporation identified as such in the Articles of Agreement. The term Contractor shall include the Contractor and its authorized representative(s) as designated to the Region in writing.

Day means a calendar day.

Drawings has the same meaning as Contract Drawings.

Equivalent means an alternative product, material or manufacturer proposed by the Contractor during the course of the Contract and demonstrated to the Region and/or the Consultant's satisfaction as being equivalent to the particular product, material or manufacturer prescribed by the Contract Documents.

Estimated Contract Price means the sum of:

(a) the products of the estimated quantities of unit price items and the applicable unit prices in the Schedule of Prices;

(b) the lump sum prices in the Schedule of Prices; and

(c) the cash allowance items in the Schedule of Prices.

Final Proper Invoice shall have the meaning prescribed in GC 18.24(b).

Final Quantity Reconciliation Meeting shall have the meaning prescribed in GC 18.24(a).

Interim Milestone means a scheduled event signifying the completion of a major deliverable or a set of related deliverables.

Local Municipality means the lower-tier municipality or municipalities, as defined in the *Municipal Act, 2001,* SO 2001, c 25, in which the Work will be undertaken.

Make Good means repairing, restoring, refurbishing, rehabilitating, or performing filling operation on any existing components disturbed due to work of this Contract, to at least the condition existing at the commencement of the Work, in terms of construction integrity, finishes, alignment with existing adjoining surfaces, compatibility of materials, sound attenuation criteria, exfiltration/infiltration requirements, air/vapour barrier and thermal continuity.

Other Contractor means a person, firm or corporation not employed by, or having a contract with, the Contractor and who is performing work at or near the Site directly or indirectly on

behalf of the Region, the Local Municipality or any other governmental agencies, property owners, developers or utility companies and their respective contractors.

Owner means The Regional Municipality of York.

Payment Period means a one month period during which work was performed. The start and end dates of the Payment Period will be determined by the Region and the Contractor at the pre-construction meeting. In the event the Region and the Contractor do not determine the start and end dates of the Payment Period, the start and end dates of the Payment Period are deemed to be the first calendar day of the month and the last calendar day of the month, respectively**.**

Place of the Work means the designated site or location of the Work.

Pre-Invoice Submission Meeting shall have the meaning prescribed in GC 18.1(a).

Preliminary Estimate for Payment (PEP) means the document that contains a description of the work performed during a Payment Period (or such other period as may be expressly stipulated in the Contract) in the form attached as Appendix A.6.

Products means material, machinery, equipment and fixtures which form part of the Work but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work which is normally referred to as construction machinery and equipment.

Professional Engineer means a person, firm or corporation legally qualified to practice professional engineering in the Province of Ontario.

Professional Geoscientist means a person, firm or corporation legally qualified to practice professional geoscience in the Province of Ontario.

Proper Invoice shall have the meaning given to it in the Construction Act.

Proper Invoice for Subcontract Holdback shall have the meaning prescribed in GC 18.23(a).

Proper Invoice Submission Date shall have the meaning prescribed in GC 18.2(a).

Region means The Regional Municipality of York or its authorized agent or representative(s) as designated to the Contractor, but does not include the Consultant.

Regional Council means the Council of the Region, as constituted from time to time.

Shop Drawings means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by the Contractor to illustrate details of a portion of the Work.

Site has the same meaning as Place of the Work.

Specifications mean that portion of the Contract Documents consisting of written technical descriptions and standards for the Products, systems, workmanship, and services necessary for the performance of the Work.

Subcontractor means a person, firm or corporation not contracting with or employed directly by the Region, but who performs a part or parts of the Work or supplies products under an agreement with the Contractor or under an agreement with another subcontractor.

Substantial Performance of the Contract means when the Contract is substantially performed pursuant to the Construction Act. If such legislation is not in force or does not contain such term, Substantial Performance of the Contract shall have been reached when the Work is ready for use or is being used for the purpose intended and is so certified by the Commissioner.

Supplier means a manufacturer, fabricator, distributor or vendor having a direct contract with the Contractor or a Subcontractor to furnish materials or equipment to be incorporated into the Work by the Contractor or a Subcontractor.

Total Performance of the Contract means when the Contract is deemed to be completed pursuant to the Construction Act. If such legislation is not in force or does not contain such term, Total Performance of the Contract shall have been reached when the entire Work, except those items arising from the provisions of GC 37 - Warranty, has been performed to the requirements of the Contract as certified by the Commissioner.

Unresolved Litigation means any unresolved dispute between the Region and any other party or related party adverse in interest, including third party and cross-claims, where a legal proceeding has been commenced for an injunction, a mandatory order, a declaration or the recovery of money.

Value Added Taxes means such sum as shall be levied upon the Contract Price by the Federal or any Provincial or Territorial Government and is computed as a percentage of the Contract Price and includes the Goods and Services Tax, the Quebec Sales Tax, the Harmonized Sales Tax, and any similar tax, the collection and payment of which have been imposed on the Contractor by the tax legislation.

Work/Works means the total construction and related services required by the Contract.

Working Day means any Day except Saturdays, Sundays and statutory holidays in the Province of Ontario.

ABBREVIATIONS

When the following abbreviations are used in the Contract Documents they have the meaning listed:

ANSI	American National Standards Institute
ASTM	ASTM International
AWWA	American Water Works Association
CGSB	Canadian General Standards Board
CSA	CSA Group (formerly Canadian Standards Association)
DFO	Fisheries and Oceans Canada
EST	Eastern Standard Time
LSRCA	Lake Simcoe Region Conservation Authority
MNRF	Ministry of Natural Resources and Forestry (Ontario)
MECP	Ministry of Environment, Conservation and Parks (Ontario) (formerly MOECC)
MOECC	Ministry of the Environment and Climate Change (Ontario)
MOL	Ministry of Labour (Ontario)
MTO	Ministry of Transportation (Ontario)
OCIP	Owner Controlled Insurance Program
OPS	Ontario Provincial Standard
OPSD	Ontario Provincial Standard Drawing
OPSS	Ontario Provincial Standard Specification
PPE	personal protective equipment
PTTW	permit to take water
RSC	Revised Statutes of Canada
RSO	Revised Statutes of Ontario
SC	Statutes of Canada
SO	Statutes of Ontario
TRCA	Toronto and Region Conservation Authority

GENERAL CONDITIONS OF THE CONTRACT

(the "General Conditions")

GC 1 Documents

1.1 The Contract Documents shall be signed in triplicate by the Region and the Contractor.

1.2 The Contract Documents are complementary and what is required by any one shall be as binding as if required by all.

1.3 The intent of the Contract Documents is to include the labour, Products, services and construction machinery and equipment necessary for the performance of the Work in accordance with the Contract. The Contractor shall, at no additional charge, supply Products and construction machinery and equipment and perform work and services consistent with, covered by, or properly inferable from, the Contract, as determined by the Commissioner.

1.4 The Contractor shall keep one copy of the current Contract Documents and Shop Drawings at the Site. The Contract Documents shall be kept in good order and shall be made available to the Region, the Consultant and their respective representatives at all times.

1.5 Drawings, specifications, models and copies thereof furnished by the Region are, and shall remain, the property of the Region with the exception of the executed Contract provided to the Contractor by the Region. Such documents and models shall be used only with respect to the Work and shall not be used on any other work. Such documents and models shall not be copied or modified in any manner without the prior written authorization of the Region.

1.6 The Contract Documents may contain references to requirements, practices, codes, regulations, manuals, standards, specifications and drawings of associations, societies, councils, boards, foundations and other government bodies, including OPS specifications and drawings, which are incorporated into the Contract by reference, and have the same force and effect as if printed in full.

1.7 Where reference is made to a requirement, practice, code, regulation, manual, standard, specification or drawings of an association, society, council, board, foundation or other government body, including OPS specifications and drawings, it is understood that the latest revision shall apply, unless indicated otherwise in the Contract Documents.

1.8 Where applicable, OPS specifications and drawings shall be amended as follows:

"Engineer" shall mean Commissioner and "Ministry" and “Authority” shall mean the Region.

1.9 If the Contractor has any doubt as to the meaning or intent of any part of the Contract Documents, it shall immediately notify, and seek clarification from the Consultant.

1.10 Any reference in the Contract Documents to a statute shall be deemed to mean the statute, as amended or replaced at the time the Contract was entered into, and also mean all regulations enacted under such statute.

1.11 Syntax:

(a) Where the words “accepted“, ”reviewed”, “designated” “directed”, “inspected“, “instructed”, “permitted”, “required”, and “selected” are used in Standards or in the Contract Documents, they are deemed to be followed by the words “by the Consultant and the Region”, unless the context provides otherwise.

(b) Where the words “acceptable”, “submit” and “satisfactory” are used in Standards or in the Contract Documents, they are deemed to be followed by the words “to the Consultant and the Region”, unless the context provides otherwise.

(c) The words “include”, “includes” or “including” mean “include without limitation”, “includes without limitation” and “including without limitation”, respectively, and the words following “include”, “includes” or “including” shall not be considered to set forth an exhaustive list.

(d) Wherever words “indicated”, “shown”, “noted”, “listed”, “specified” or similar words are used in the Contract Documents they are understood, unless otherwise defined, to mean “indicated”, “shown”, “listed”, “noted” or “specified” on the Contract Documents, unless the context provides otherwise.

(e) Reference to the word “Section” or “Sections” in the Contract Documents shall mean a Section or Sections of the Divisions of the Specifications.

1.12 It is the parties’ mutual intention that the Contract Documents comply with section 4 of the Canada-European Union Comprehensive Economic and Trade Agreement and section 3 of the Canadian Free Trade Agreement. Any reference in the Contract Documents to a particular product, material or manufacturer shall be deemed to include the words “or Equivalent” immediately following such reference (unless the words “or Equivalent” already follow the product, material or manufacturer reference).

GC 2 Order of Precedence

2.1 In the event of conflicts or inconsistencies in the Contract Documents:

(a) the order of priority from highest to lowest, shall be as follows:

- Addenda
- Articles of Agreement
- Permits
- Supplementary Conditions
- General Conditions
- Definitions
- Bid
- Specifications
- Drawings

(b) figured dimensions shown on a Drawing shall govern where they differ from dimensions scaled on the same Drawing;

(c) Drawings of larger scale shall govern over those of smaller scale of the same date;

(d) executed amendments to specific parts of the Contract Documents shall govern over the executed specific parts in Contract Documents affected by the amendments; and

(e) later dated documents shall govern over earlier documents of the same type.

2.2 In the event of conflicts or inconsistencies between the specifications of the Region and the specifications of other entities, including OPS specifications and drawings, the specifications of the Region shall govern.

GC 3 Consultant

3.1 The Region may appoint from time to time such person, firm or corporation (the "**Consultant**") as the Region may deem appropriate to visit the Place of the Work in order to monitor the progress and quality of the Work and compliance with the terms of the Contract Documents.

3.2 The Consultant will not be responsible for, and will not have control, charge or supervision of, construction means, methods, techniques, sequences or procedures, or for safety precautions and programs required in connection with the Work in accordance with the applicable construction safety legislation, other regulations or general construction practice. The Consultant will not be responsible for, or have control or charge over, the acts or omissions of the Contractor, its Subcontractors or their respective agents, employees or other persons performing any of the Work, including any failure to comply with the terms of the Contract.

3.3 If a Consultant has been appointed by the Region, the Consultant will be, in the first instance, the interpreter of the requirements of the Contract and the judge of the performance thereunder by the Contractor.

3.4 Claims, disputes and other matters in question relating to the performance of the Work or the interpretation of the Contract shall be referred to the Consultant, in writing, for a decision.

3.5 The Contractor shall provide, at no additional cost, all reasonable aid and assistance required by the Region and the Consultant for the review and observation of all aspects of the Work, including, but not limited to, inspection of all facilities and the taking of all test samples.

3.6 If, through the omission, default, neglect or delay, or other action on the part of the Contractor, it is necessary for the Consultant or the Region to attend the Place of the Work more often than the Region deems reasonable, the Region may charge the actual costs for the additional visits to the Contractor, including all travel-related expenses, which costs shall be payable by the Contractor on demand.

3.7 The Consultant shall have the authority to reject work which, in its opinion, does not conform to the requirements of the Contract. Whenever the Consultant considers it necessary or advisable, the Consultant has the authority to require inspection or testing of the Work, whether or not such work is fabricated, installed or completed.

GC 4 Delays

4.1 The Contractor shall not have any claim for compensation or damages against the Region for any stoppage or delay from any cause whatsoever.

4.2 Should a stoppage or delay be caused by, or result from, the action or neglect of any Other Contractor performing work under the provisions of a contract with the Region, the Region may give notice in writing to the Contractor to stop the Work, and the Contractor shall not have any claim for compensation or damages against the Region for this delay.

4.3 Should the amount authorized for the Work be at any time expended prior to the completion of the Work, the Region may provide written notice to the Contractor that further authorization is required for the release of any additional funds. Upon receipt of this notice, the Contractor may stop the Work; but in any event the Contractor shall not be entitled to any further payment for work done after service of this notice until the additional funds have been authorized, nor shall the Contractor have any claim for compensation or damages for any suspension of, or delay in, payment.

4.4 The Region may direct the Contractor to stop any portion of the Work if, for any reason, the requisite approvals from Regional Council or any applicable governmental or municipal authority have not been obtained, have expired, or have been revoked.

4.5 The Region or the Consultant may direct the Contractor to stop any portion of the Work if, in its judgment, weather conditions will prevent or impede the completion of the Work.

4.6 The Region or the Consultant may direct the Contractor to stop any portion of the Work if, in its judgment, that portion of the Work is not being completed in accordance with the requirements of the Contract.

GC 5 Extension of Contract Time

5.1 An extension of the Contract Time may be granted by the Region as a result of delays caused by:

(a) abnormal inclement weather;

(b) general strikes;

(c) work stoppages pursuant to GC 4 - Delays, paragraphs 4.2 to 4.5 inclusive;

(d) Changes in the Work pursuant to GC 14 - Changes in the Work, paragraph 14.1; and

(e) any other cause which could not be reasonably anticipated to occur during the course of a construction project, which the Region deems to be beyond the Contractor's (including any Subcontractors) reasonable control (other than financial incapacity). For the purpose of this provision, delays in the supply and/or delivery of materials, Products and/or equipment, or arising from the breakdown of equipment, do not constitute causes which are beyond the Contractor’s control.

5.2 Extensions of Contract Time may be for any period of time that the Region, in its sole opinion, deems appropriate. The Region shall establish the terms upon which any extension may be granted, which terms may include a charge for additional expenses incurred by the Region during the period covered by said extension.

5.3 Such extension of Contract Time shall be deemed to be full compensation for any loss or injury sustained by the Contractor as a result of any of the delays described above and the Contract shall not be invalidated by the granting of such extension.

5.4 Application for an extension of Contract Time as herein provided shall be made by the Contractor to the Region not later than two Business Days following the commencement of the delay and at least 10 Business Days prior to the expiration of the Contract Time.

5.5 In addition to the requirements of GC 5.4, the Contractor shall submit to the Region for approval on a weekly basis, a written statement showing the number of Days lost due to delay caused by abnormal inclement weather in the preceding week, the extension of Contract Time (in terms of Working Days) which is requested by the Contractor as a result of such delay, and the number of Working Days remaining to complete the Work. The Region shall advise the Contractor as to the length of extension granted, if any, within five Business Days of receipt of the Contractor's written statement. In the event that the Contractor fails to provide a statement requesting an Extension of Contract Time for any given week within five Business Days of the end of that particular week, the Contractor shall be deemed to have waived any right to request an Extension of Contract Time for that week.

5.6 For the purposes of this GC 5 - Extension of Contract Time, a delay caused by abnormal inclement weather occurs when, in the Region's sole opinion, the Contractor is prevented by inclement weather or other related conditions, for a period of at least six hours in a Working Day, from proceeding with at least 60% of the normal labour and equipment force engaged on any component of the Work which, if delayed, will delay the completion of the Work.

5.7 The parties acknowledge that in March 2020 the World Health Organization declared a global pandemic of the virus leading to COVID-19. The Government of Canada and the Province of Ontario responded to the pandemic with legislative amendments, controls, orders, requests of the public, and requests and requirements to the parties to change their activities in various ways (collectively, the "**Governmental Response**"). It is uncertain how long the pandemic, and the related Governmental Response, will continue, and it is unknown whether there may be a resurgence of the virus leading to COVID-19 or any mutation thereof (collectively, the "**Virus**") and resulting or supplementary renewed Government Response. Notwithstanding any other provision in the Contract Documents, if the Contractor is delayed in the performance of the Work by the continued spread of the Virus and/or the continuation of or a renewed Governmental Response to control the spread of the Virus (which was not reasonably foreseeable at the time of entering into the Contract), the parties agree it shall constitute a delay pursuant to GC **Error! Reference source not found.**. The Contractor shall not be entitled to any payment for costs incurred by such delays, save and except as provided for in
GC 5.8. Nothing in this GC 5.7 shall excuse the Contractor from complying with any application notification requirements in the Contract including, without limitation, those contained in GC 5.4 and GC **Error! Reference source not found.**.

5.8 In the event of a delay to the Contractor's performance of the Work pursuant to GC 5.7, notwithstanding GC **Error! Reference source not found.**, the Contractor shall be entitled to payment of the direct costs it reasonably incurs, without any mark-up for overhead

and profit, as a result of having to comply with new legislative amendments, controls, and orders that are implemented by the Government of Canada or the Province of Ontario after the Bid closing date in response to the Virus associated with the following:

(a) the Contractor being required to use additional tools or equipment, including PPE equipment, in its performance of the Work;

(b) the Contractor being required to purchase, use or provide additional safety-related supplies in connection with its performance of the Work; or

(c) the Contractor being required to install temporary facilities or structures, including hand washing stations.

5.9 Notwithstanding any other provision in the Contract, the Region shall not be liable or deemed to be in breach of the Contract for any failure or delay in performance of its obligations under the Contract arising out of:

(a) the Virus;

(b) Governmental Response; or

(c) any impacts to the Region's operations and performance of its obligations that are beyond its reasonable control and are caused by, relate to or arise out of the Virus or the Governmental Response (including, without limitation, any delays in obtaining possession or access to the Place of the Work, or in obtaining permits from permitting offices or approvals from authorities having jurisdiction).

GC 6 Region's Right to Perform the Work or Stop the Work or Terminate the Contract

6.1 If circumstances arise such that the Region considers it necessary or advisable, the Region may suspend the Contract and the performance of the Work. In the event the Region exercises its right of suspension pursuant to this GC 6.1, the Contractor shall, subject to the directions in the notice of suspension:

(a) take all necessary steps to ensure the Place of the Work and all Work in place is left in a safe and clean state and is protected from the elements for the duration of the suspension; and

(b) take all necessary steps to ensure the Work is appropriately preserved and cared for in accordance with good industry practice and any occupational, use or safety requirements or standards of the authorities having jurisdiction or stipulated in the Contract Documents for the duration of the suspension.

If the Contract and the performance of the Work is suspended pursuant to this GC 6.1, the Contract Time shall be extended by the length of the suspension and the Region shall pay the Contractor the direct costs the Contractor reasonably incurs that are a

direct result of any demobilization, remobilization and site security and preservation that is required as a result of the suspension. All such costs shall be substantiated with sufficient and appropriate supporting documentation.

6.2 If:

(a) the Contractor becomes bankrupt or insolvent or makes a general assignment for the benefit of creditors because of its insolvency;

(b) a receiver is appointed because of the Contractor's insolvency;

(c) the Contractor commits a criminal act;

(d) the Contractor transfers, assigns or otherwise disposes of its interest in the Contract, or any part thereof, without the written authority of the Region;

(e) the Contractor ceases the Work for a period of 30 Days or more (other than for delays for which an extension of Contract Time is granted by the Region pursuant to GC 5 - Extension of Contract Time);

(f) the Region deems, in its sole discretion, that the progress of the Work has fallen behind schedule to such an extent that the Contractor will not be able to meet one or more of the Interim Milestone dates specified in the Contract and/or complete the Work within the Contract Time;

(g) the Contractor fails to maintain adequate insurance as stipulated in GC 24 - Insurance;

(h) the Contractor fails to comply immediately with a direction of the Region or the Consultant under the Contract including, but not limited to, any directions under GC 65 - Compliance with the Occupational Health and Safety Act or GC 68 - Compliance with Environmental Legislation;

(i) the Contractor fails to comply immediately with a stop work order issued by the Region or the Consultant;

(j) the Contractor fails to comply with a written direction from the Region or the Consultant under GC 7.4; or

(k) the Contractor commits any other breach of Contract which the Region deems material

the Region, without prejudice to any other right or remedy it may have, may by giving the Contractor or receiver or trustee in bankruptcy written notice:

(l) terminate the Contract;

(m) take all or any part of the Work out of the Contractor's hands and employ such means as it sees fit to complete the Work, and deduct the costs thereof from

any payment due to the Contractor and, in the event that the costs thereof exceed the sum payable to the Contractor had the Contractor completed that part of the Work, the Contractor shall pay such excess amount to the Region forthwith upon notice from the Region; or

(n) issue a stop work order.

6.3 If the Contractor fails to perform the Work in compliance with the requirements of the Contract, of which the Commissioner shall be the sole judge, the Region may notify the Contractor in writing that it is in default of its contractual obligations and instruct it to correct the default no later than five Working Days following receipt of such Notice or, where immediate action is required, in such lesser time as specified in the Notice.

6.4 If the correction of the default cannot be completed within five Working Days, or such lesser time as specified in the Notice, the Contractor shall be in compliance with the Region's instructions if it:

(a) commences the correction of the default within the specified time;

(b) provides the Region with a schedule acceptable to the Region for such correction; and

(c) completes the correction in accordance with such schedule.

6.5 If the Contractor fails to correct the default within the time specified, the Region may, without prejudice to any other right or remedy it may have:

(a) correct such default and charge the cost thereof to the Contractor;

(b) terminate the Contractor's right to continue with the Work, in whole or in part; or

(c) terminate the Contract.

6.6 If the Region terminates the Contractor's right to continue with the Work or terminates the Contract, the Region shall be entitled to:

(a) take possession of the premises and Products, utilize the construction machinery and equipment and finish the Work by whatever method it sees fit;

(b) receive an assignment or transfer forthwith from the Contractor of any permit or approval obtained by the Contractor for the performance of the Work;

(c) assert any right of set-off in accordance with GC 71 - Right of Set-Off;

(d) withhold further payments to the Contractor until the Work is finished;

(e) deduct the following costs from the unpaid balance of the Contract Price:

(i) the full cost of completing the Work, as certified by the Commissioner;

(ii) any additional compensation payable to the Consultant for additional services; and

(iii) a reasonable allowance, as determined by the Commissioner, to cover the cost of corrections to the Work as may be required under GC 37 - Warranty,

and,

(f) upon the expiration of the warranty period, charge the Contractor the amount by which the cost of corrections to its work under GC 37 - Warranty exceeds the allowance provided for such corrections.

If the costs referred to in GC 6.6(e) and GC 6.6(f) are less than the unpaid balance of the Contract Price, the Region shall pay the Contractor the difference.

6.7 The Contractor acknowledges that the performance of the Work may require the following:

(a) approval of the local conservation authority and/or other applicable government agencies in respect of watercourses, wetlands, floodplain, and hazard lands;

(b) approval of MNRF, DFO and/or the local conservation authority in respect of its authority under the *Fisheries Act*, RSC 1985, c F-14;

(c) approval of MECP, the local conservation authority and/or other applicable government agencies in respect of any water taking;

(d) approval of MECP in respect of any discharge, emission, waste, waste disposal site, waste management system, water works, sewage works, storm water works and/or drinking water systems;

(e) approval of MNRF, DFO and/or Environment Canada in respect of the protection of any species at risk and/or the respective habitat of any species at risk;

(f) approval of the applicable railways in respect of rail crossings at grade or grade separations;

(g) approval of MTO;

(h) approval of Transport Canada in respect of navigable waterbodies;

(i) approval of the MOL and MECP, as applicable, in respect of any new equipment specified by the Region;

(j) approval of Regional Committee/Council and/or other governmental or municipal authorities or utilities; and/or

(k) land acquisitions, easements or utility relocations.

If at any time any one or more of these requirements have not been satisfied, the Region may terminate the Contract by providing written notice to the Contractor to such effect and the Contractor shall be entitled to be paid for the Work performed up to and including the date of service of the notice terminating the Contract, as determined by the Commissioner. In no event will the Contractor be entitled to claim any amount for profit or loss sustained or any other damages as a result of the termination of the Contract.

6.8 If at any time during the course of the Contract, the Region exhausts or exceeds the allocated budget for the Contract, or if the allocated budget for the Contract is withdrawn, reduced or cancelled by Regional Council for any reason whatsoever, the Region may terminate the Contract by providing written notice to the Contractor to such effect and the Contractor shall be entitled to be paid for the Work performed up to and including the date of service of the notice terminating the Contract, as determined by the Commissioner. In no event will the Contractor be entitled to claim any amount for profit or loss sustained or any other damages as a result of the termination of the Contract.

6.9 If the Work is suspended or otherwise delayed for a period of 60 consecutive Working Days or more under an order of a court or other public authority and providing that the issuance of such order was not the direct result of an act or omission of the Region or Consultant contrary to the provisions of the Contract Documents, the Region may, at its sole option and discretion and without penalty, terminate the Contract for convenience upon providing seven (7) Days' written notice to the Contractor. Upon receiving the notice of termination in accordance with this paragraph, the Contractor shall cease or cause the cessation of all operations except for the following:

(a) The Contractor shall take all steps necessary to:

(i) ensure and preserve the safety or personnel (including, without limitation, construction personnel, building residents, building guests and building staff); and

(ii) ensure the Work is appropriately preserved and cared for in accordance with good industry practice and any occupational, use or safety requirements or standards of authorities having jurisdiction or those stipulated in the Contract Documents.

(b) Subject to any directions in the notice of termination, the Contractor shall:

(i) take all necessary steps to ensure the Place of the Work and all Work in place is left in a safe and clean state and is protected from the elements; and

(ii) discontinue or cause to be discontinued the ordering of products, material, equipment and supplies and shall make reasonable efforts to cancel existing orders on the best terms available.

If the Contract is terminated for convenience pursuant to this GC 6.9, the Contractor shall not be entitled to any costs, expenses, damages, losses or reimbursement of any kind whatsoever (and the Contractor waives any claim against the Region related to or arising from the termination), save and except for the amounts expressly contemplated in GC 6.10.

6.10 If the Contract is terminated pursuant to GC 6.9, the Region shall pay the Contractor the cost of the Work incurred to the effective termination date and the reasonable costs the Contractor incurs in complying with its obligations under GC 6.9.

6.11 The Contractor's obligation under the Contract as to quality, correction and warranty of the Work performed by it up to the time of termination shall continue in force after such termination.

6.12 Notwithstanding any other provision in the Contract, the Region shall not be liable to the Contractor for any actual or alleged damages of any kind whatsoever (including without limitation indirect, incidental, special, consequential or other damages, including loss of profits) on account of the publication of a Notice of Termination pursuant to the Construction Act and the Contractor waives any and all claims against the Region related to or arising from the publication. This GC 6.12 shall survive termination of the Contract.

GC 7 Claims, Disputes and Adjudication

7.1 Subject to GC 7.9 to GC 7.13, differences between the parties to the Contract as to the interpretation, application or administration of the Contract, or any claims which the Contractor has which may result in an increase in the Contract Price, or an extension of Contract Time, or any failure to agree where agreement between the parties is called for, other than a failure to agree on the method of valuation, measurement and change in the Contract Price which shall be governed by GC 15 - Change Order and GC 16 - Change Directive, which differences are not resolved in the first instance by decision of the Consultant pursuant to the provisions of GC 3 - Consultant, paragraphs 3.3 and 3.4, if applicable, shall be settled in accordance with this General Condition.

7.2 The Contractor shall give oral notice of any claim or dispute to the Region and the Consultant immediately upon becoming aware of the circumstances giving rise to such claim or dispute.

7.3 The Contractor shall provide written notice of any claim or dispute to the Region and the Consultant, within five Business Days after the commencement of the work giving

rise to the claim or dispute. Such notice shall include particulars of the claim or matter in dispute, the extent and value of the claim and the relevant provisions of the Contract Documents.

7.4 Upon receipt of written direction from the Region or the Consultant, the Contractor shall continue to perform the Work in accordance with the instructions of the Region or the Consultant.

7.5 The Contractor shall submit to the Region and the Consultant, a detailed statement of its claim not later than 25 Business Days after completion of the work which is the subject of the claim or dispute, identifying the item or items in respect of which the claim or dispute has arisen, the grounds upon which a claim is made and all records substantiating such claim.

7.6 The Contractor shall promptly submit, at the request of the Region or the Consultant, such further and other information and documentation as the Region or the Consultant consider necessary to assess the claim.

7.7 If the Contractor fails to comply with the time limits set out in this GC 7 - Claims, Disputes and Adjudication in respect of any claim or dispute, the Contractor will not be entitled to proceed with any such claim or dispute and this provision shall act as a bar to any such claims or disputes.

7.8 If the Contractor has complied with all of the provisions of this GC 7 - Claims, Disputes and Adjudication and the Region and the Contractor cannot resolve the claim or dispute, the claim or dispute shall be determined by a court of competent jurisdiction once Total Performance of the Contract has been achieved.

7.9 Notwithstanding anything else in this GC 7 - Claims, Disputes and Adjudication, the Region and the Contractor shall engage in adjudication as required by, and in accordance with, the Construction Act.

7.10 If the Contractor fails to comply with the time limits set out in this GC 7 - Claims, Disputes and Adjudication in respect of any claim or dispute, the Contractor shall have no entitlement whatsoever (including to an increase in the Contract Price, or an extension of Contract Time) in the context of an adjudication under the Construction Act, and waives the right to make any such claims or disputes in an adjudication. This GC 7.10 shall operate conclusively as an estoppel and bar in the event such claims or disputes are brought in an adjudication and the Region may rely on this GC 7.10 as a complete defence to any such claims or disputes.

7.11 The following procedures shall apply to any adjudication the Region and the Contractor engage in under the Construction Act:

(a) any hearings shall be held at a venue within the jurisdiction of the Place of the Work or such other venue as the Region and the Contractor may agree and which is acceptable to the adjudicator;

(b) the adjudication shall be conducted in English;

(c) the Region and the Contractor may be represented by counsel throughout an adjudication;

(d) there shall not be any oral communications with respect to issues in dispute that are the subject of an adjudication between a party and the adjudicator unless it is made in the presence of both parties or their legal representatives;

(e) a copy of all written communication between the adjudicator and a party shall be given to the other party at the same time.

7.12 Any documents or information disclosed by the parties during an adjudication are confidential and the parties shall not use such documents or information for any purpose other than the adjudication in which they are disclosed and shall not disclose such documents and information to any third party, unless otherwise required by law, save and except the for the adjudicator.

7.13 Notwithstanding any adjudication between the parties, there shall be no interruption of the Work pending settlement or resolution of such dispute or disagreement.

GC 8 Assignment

8.1 The Work to be performed under the Contract, or any part thereof, or any monies payable under the Contract, shall not be transferred, assigned or otherwise disposed of by the Contractor without the prior written authorization of the Region, which authorization may be unreasonably withheld. It is further agreed that the said written authorization shall not, under any circumstances, relieve the Contractor of its liabilities and obligations under the Contract.

GC 9 Other Contractors

9.1 The Region reserves the right, at any time during the Contractor's performance of the Work or the warranty period, to request that the Contractor grant to the Region, its agents and Other Contractors, access to the Site for the purpose of constructing or installing collateral work as the Region may deem necessary. This work may include adjustment of services, structures and service poles by utility companies or their contractors.

9.2 The Contractor shall co-ordinate the Work with the work of Other Contractors and, where applicable, prepare all connections as specified or shown in the Contract Documents.

9.3 The Contractor shall report to the Region and the Consultant any apparent deficiencies in Other Contractors' work which could affect the Work immediately upon becoming aware of the deficiencies, and shall confirm such report in writing within five Business Days. Failure by the Contractor to report apparent deficiencies shall invalidate any claims against the Region by reason of the deficiencies of Other Contractors' work.

9.4 The Contractor agrees not to interfere with, or prevent, the performance of such collateral work by the agents or Other Contractors of the Region, or to claim any extra compensation or damages by reason of delays or hindrances which may be caused by the construction or installation of such collateral works.

9.5 Entry by the Region, the Consultant, or Other Contractors to the Site does not constitute acceptance of the Work and does not relieve the Contractor of its responsibilities under the Contract.

9.6 The placement, installation and connection of collateral work by the Region, its agents or Other Contractors on, and to, the Contractor's Work does not relieve the Contractor of its responsibilities under the Contract, including any warranty obligations.

9.7 In the event that the Work coincides with the work of the Region, Other Contractors, utility companies and/or Local Municipality, the Contractor shall cooperate with the Region, Other Contractors, utility companies and Local Municipality in order to facilitate free access to their work at all times. The Region reserves the right to alter the method of operations on this Contract to avoid interference with other work. The Contractor shall also provide separations in time and/or space (a minimum of 50 metres from the Other Contractors' proposed work area) in order to avoid placing the Region in the position of "Constructor" within the meaning prescribed in the *Occupational Health and Safety Act*, RSO 1990, c O.1.

GC 10 Subcontractors

10.1 The Contractor shall preserve and protect the rights of the parties under the Contract with respect to work to be performed under subcontract and shall:

(a) enter into contracts or written agreements with its Subcontractors to require them to perform their work in accordance with, and subject to, the terms and conditions of the Contract; and

(b) be as responsible to the Region for acts and omissions of its Subcontractors and of persons directly or indirectly employed by them as for acts and omissions of persons directly employed by it.

The Contractor shall incorporate the terms and conditions of the Contract into all subcontract agreements it enters into with its Subcontractors.

10.2 The Contractor shall employ only those Subcontractors proposed by it in the Schedule of Subcontractors included in its Bid.

10.3 In the event that the Contractor requires a change of a Subcontractor or an additional Subcontractor, the Contractor shall obtain the prior written approval of the Region to such replacement Subcontractor or new Subcontractor, which approval may be unreasonably withheld. In no event will the Contract Price be increased as a result of such change.

10.4 The Region's consent to subcontracting or approval of a change in Subcontractor by the Contractor shall not be construed to relieve the Contractor from any obligation under the Contract and shall not impose any liability upon the Region. Nothing contained in the Contract shall create a contractual relationship between a Subcontractor and the Region.

GC 11 Work Schedule

11.1 Unless specified otherwise in the Contract Documents, the Contractor shall submit a work schedule to the Region for approval within five Business Days of receipt of written notice to the Contractor to commence the Work. The work schedule shall be in a format acceptable to the Region, indicate the timing of the major activities of the Work, and be designed to ensure completion of the Work within the Contract Time. The Contractor shall not commence the Work until the work schedule has been reviewed and approved by the Region.

11.2 The Contractor shall perform the Work in accordance with the approved schedule. The Contractor shall notify the Region in writing at least 24 hours prior to any anticipated deviation from the approved schedule.

11.3 On the first Working Day of each week, the Contractor shall give the Region a written detailed schedule listing the operations and work areas for that week in a form acceptable to the Region.

11.4 Should the Contractor fail to comply with the requirements contained in this General Condition, the Region shall be entitled to withhold all, or any part, of the progress payments to be made to the Contractor until such time as the Contractor has met these requirements.

GC 12 Noise Bylaw Restrictions

12.1 The Contractor shall comply with all applicable local bylaws regarding noise and hours of work. These bylaws are under the jurisdiction of the Local Municipality, and the Region has no authority to grant exemptions from them.

12.2 All vehicles and equipment shall be equipped with efficient muffling devices to minimize noise levels at the Site. In particular, equipment such as compressors, gas and diesel driven engines shall be equipped with efficient mufflers.

12.3 The Contractor shall establish and maintain site procedures consistent with the objective that noise levels from the Site shall be minimized, with due consideration to tenants in any the Region properties, and in accordance with local bylaws.

GC 13 Notice to the Region

13.1 The Contractor shall notify the Region a minimum of 24 hours in advance of commencing a new operation or resuming an operation after a stoppage.

GC 14 Changes in the Work

14.1 The Region, without invalidating the Contract, may make Changes in the Work by providing the Contractor with a Change Order or Change Directive. The Contractor shall provide an updated schedule in the event that the Change Order or Change Directive affects the progress of the Work.

14.2 The Contractor shall not proceed with any Changes in the Work until it has received a copy of the Change Order or Change Directive signed by the Region. No claims for changes in the Contract Price or Contract Time shall be valid unless provided for by the Region in a Change Order.

14.3 Any Change Order executed by the parties shall be deemed to include any credits to be applied to the Contract Price, and any and all direct and indirect costs which will be incurred by the Contractor as a result of the Change in the Work including, but not limited to, labour, materials, equipment, bonding, insurance, overhead, profits, and delay costs, and the Contractor shall not be entitled to claim any additional compensation for these items.

14.4 The Contractor shall not be entitled to receive any additional compensation arising out of Changes in the Work other than the amounts determined and agreed to under GC 15 - Change Order, or as provided for in GC 16 - Change Directive.

14.5 If any Change in the Work is made which results in a reduction in the amount of work to be done, including reductions in any of the quantities specified in Contract Documents or the deletion of any items in the Bid, or if all or any component of the Work is deleted from the scope of Work, the Contractor and its Subcontractors shall not be entitled to compensation for any such changes, including any claims for loss of anticipated profits.

14.6 The Contractor shall include the value of work performed under a Change Order during a Payment Period in the Proper Invoice that the Contractor submits pursuant to GC 18.2 in respect of that Payment Period.

14.7 Following completion of a Change in the Work, the Contractor shall include all outstanding costs associated with the completed Change in the Work in the next Proper Invoice the Contractor is required to give to the Region in accordance with GC 18-Certificates and Payments. Following submission of the Proper Invoice referred to in the immediately preceding sentence, the Contractor shall not be entitled to any further or additional payment or compensation of any kind whatsoever on account of the Change in the Work and waives any and all claims associated with the completed Change in the Work.

GC 15 Change Order

15.1 When a Change in the Work is proposed or requested, the Region will prepare a Contemplated Change Order ("**CCO**") describing the proposed change(s) and submit it to the Contractor for consideration.

15.2 The Contractor shall submit, within five Business Days of receipt of the CCO, or such other time agreed to by the Contractor and the Region, a quotation which includes its proposed method and amount of adjustment to the Contract Price, if any, and the proposed adjustment to the Contract Time for the work included in the CCO, together with any supporting documentation which may be required by the Region.

15.3 The Region will assess the merits of the proposed adjustments to the Contract Price and/or the Contract Time. If the Region and the Contractor agree to the adjustments in the Contract Price and/or the Contract Time, or the method to be used to determine the adjustments, such agreement shall be effective immediately and shall be recorded in a Change Order.

GC 16 Change Directive

16.1 If the Region requires the Contractor to proceed with a Change in the Work prior to the Region and the Contractor agreeing upon the adjustments to the Contract Price and/or the Contract Time, the Region shall issue a Change Directive. Upon receipt of the Change Directive, the Contractor shall promptly proceed to execute the work described in the Change Directive.

16.2 The adjustment to the Contract Price for a change carried out pursuant to a Change Directive shall be determined using one of the following methods:

(a) Estimate and acceptance of a lump sum;

(b) Unit prices set out in the Contract or subsequently agreed upon;

(c) Actual cost of expenditures and savings to perform the work attributable to the change, plus mark-up as specified in GC 17 - Mark-Ups.

16.3 In the case of a Change in the Work to be valued in accordance with the method prescribed in GC 16.2(a), the Contractor shall, within five Business Days or such other time agreed to by the Contractor and the Region, present to the Region, for approval, a detailed estimate of the costs of the Contractor and the involved Subcontractors, including products, labour itemized by man hours, labour burden and the overhead and profit of each of the involved Subcontractors shown separately.

16.4 In the case of a change to be valued under methods prescribed in GC 16.2(b) or GC 16.2(c), the form of presentation of costs and methods of measurement shall be agreed to by the Region and the Contractor before proceeding with the change.

16.5 When the method prescribed in GC 16.2(c) is used to determine the value of a change in the Work, the Contractor shall keep and present, in such form as the Region may require, an itemized accounting of the actual cost of expenditures and savings, together with supporting data. The cost of performing the work attributable to the Change Directive shall be limited to the actual cost of the items contained in GC 16.6(a) to GC 16.6(q).

16.6 The cost of performing the work attributable to the Change Directive shall be limited to the actual cost of the following:

(a) salaries, wages and benefits paid to personnel in the direct employ of the Contractor, for personnel:

(i) carrying out the work, including necessary supervisory services;

(ii) engaged in the preparation of Shop Drawings, fabrication drawings, coordination drawings and as-built drawings; or

(iii) engaged in the processing of Changes in the Work.

(b) contributions, assessments or taxes incurred for such items as employment insurance, provincial or territorial health insurance, workers' compensation, and Canada or Quebec Pension Plan, insofar as such cost is based on wages, salaries or other remuneration paid to employees of the Contractor and included in the cost of the Work as provided in GC 16.6(a);

(c) travel and subsistence expenses of the Contractor's personnel described in GC 16.6(a);

(d) all products, including cost of transportation thereof;

(e) materials, supplies, construction equipment, temporary work, and hand tools not owned by the workers, including transportation and maintenance thereof, which are consumed in the performance of the Work; and cost less salvage value on such items used but not consumed, which remain the property of the Contractor;

(f) all tools and construction equipment, exclusive of hand tools used in the performance of the Work, whether rented from or provided by the Contractor or others, including installation, minor repairs and replacements, dismantling, removal, transportation, and delivery cost thereof;

(g) all equipment and services required for the Contractor's field office;

(h) deposits lost;

(i) the amounts of all subcontracts;

(j) quality assurance such as independent inspection and testing services;

(k) charges levied by authorities having jurisdiction at the Site;

(l) royalties, patent licence fees and damages for infringement of patents and cost of defending suits therefor subject always to the Contractor's obligations to indemnify the Region as provided in GC 21 - Patent Fees;

(m) any adjustments in premiums for all bonds and insurance which the Contractor is required to purchase and maintain under the terms of the Contract;

(n) any adjustment in taxes, other than HST, and duties for which the Contractor is liable;

(o) charges for long distance telephone and facsimile communications, courier services, expressage, and petty cash items incurred in performing the work;

(p) removal and disposal of waste products and debris; and

(q) any additional safety measures and requirements.

16.7 The cost of any item referred to in GC 16.6 shall not include any costs or liabilities attributable to any failure on the part of the Contractor to exercise reasonable care and diligence in the Contractor's attention to the work. Any such costs shall be borne by the Contractor.

16.8 For the purpose of valuing Change Directives, the Region shall be afforded reasonable access to all of the Contractor's pertinent documents related to the cost of performing the work attributable to the Change Directive.

16.9 Pending determination of the final amount of a Change Directive, the Contractor shall include the undisputed value of work performed under a Change Directive during a Payment Period in the Proper Invoice that the Contractor submits pursuant to GC 18.2 in respect of that Payment Period.

16.10 If the Region and the Contractor do not agree on the proposed adjustment to the Contract Time attributable to the change in the Work, or the method of determining it,

the adjustment shall be deemed to be a "dispute" under GC 7 - Claims, Disputes and Adjudication.

16.11 If the Region and the Contractor agree to the adjustments in the Contract Price and/or Contract Time, or the method to be used to determine the adjustments, such agreement shall be effective immediately and shall be recorded in a Change Order.

GC 17 Mark-Ups

17.1 Any mark-ups payable under the Contract shall be in accordance with the following Table of Mark-Ups. The Subcontractor and Contractor's percentage fee mark-ups include all necessary supervision, general account items, general clean-up, small tools, as-built drawings and job safety necessary to perform the change.

TABLE OF MARK-UPS*		
Costs	Subcontractor and Contractor's Own Forces Mark Up (%) (includes overhead and profit)	Contractor Mark Up (%) on Subcontractor Work (includes overhead and profit)
$1.00 to $10,000.00	10	5
$10,000.01 to $50,000.00	8	5
Over $50,000.00	5	3

* each percentage specified in the table above is not cumulative but is applied to the costs only

GC 18 Certificates and Payments

18.1 Pre-Invoice Submission Meeting

(a) Five Days prior to the end of the Payment Period, or at such other time agreed to by the Region and the Contractor in writing, the Contractor, the Region and the Consultant shall attend a meeting to discuss and review the work completed during the Payment Period, including quantities if applicable (the "**Pre-Invoice Submission Meeting**"). In the event that the scheduled date for the Pre-Invoice Submission Meeting is not a Business Day, the Pre-Invoice Submission Meeting shall occur on the next Business Day, or on another Day agreed to by the Contractor and the Region in writing.

(b) The Contractor shall bring with it to the Pre-Invoice Submission Meeting the following:

(i) its Preliminary Estimate for Payment for the current Payment Period;

(ii) any documents the Contractor is required to bring to the Pre-Invoice Submission Meeting as stipulated in the Specifications;

(iii) any other documents reasonably required by the Consultant.

18.2 Submission of a Proper Invoice

(a) The Contractor shall give a Proper Invoice to the Commissioner and Consultant, in accordance with GC 18.2(b), for work performed during a Payment Period on the [fourteenth (14th)] Day following the conclusion of the Payment Period to which the Proper Invoice relates (the "**Proper Invoice Submission Date**"), subject to the following:

(i) if the [fourteenth (14th)] Day following the conclusion of the Payment Period to which a Proper Invoice relates falls on a Day that is not a Business Day, the Proper Invoice Submission Date shall be deemed to fall on the next Business Day; and

(ii) if the [fourteenth (14th)] Day following the conclusion of the Payment Period to which a Proper Invoice relates falls on a Day during the month of December, the Proper Invoice Submission Date shall be deemed to fall on the next Business Day in January of the following year.

(b) Proper Invoices shall be given in accordance with the following:

(i) Proper Invoices shall be uploaded to https:constructioninvoices.york.ca (the "**PI Portal**");

(ii) Proper Invoices shall be uploaded during the hours of 8:30 a.m. to 4:30 p.m. (EST) on the Proper Invoice Submission Date.

(iii) If a Proper Invoice is uploaded after 4:30 p.m. on the applicable Proper Invoice Submission Date, the Proper Invoice will not be considered or reviewed by the Commissioner and Consultant until the next Proper Invoice Submission Date, at which point the Proper Invoice will be deemed to have been given to the Commissioner and the Consultant. Notwithstanding GC 18.2(a) and the immediately preceding sentence, if a Proper Invoice is uploaded after 4:30 p.m. (EST) on the Proper Invoice Submission Date, the Region reserves the right, in its absolute and unfettered discretion, to consider the Proper Invoice as being given in accordance with the Construction Act on the date and at such time as it was uploaded. The Region's exercise of the right conferred to it in this paragraph shall not be construed as a waiver of any of its rights or waive or release the Contractor's obligations to strictly comply with the requirements prescribed in GC 18.2.

(iv) If the Proper Invoice is uploaded before the Proper Invoice Submission Date, the Proper Invoice will not be considered or reviewed by the Commissioner and Consultant until the applicable Proper Invoice Submission Date, at which point the Proper Invoice will be deemed to have been given to the Commissioner and Consultant.

(c) The Parties hereby consent to the giving and receiving of Proper Invoices in accordance with the requirements of GC 18.2(b), and without limiting the generality of the foregoing, consent to the giving and receiving of Proper Invoices through the PI Portal and the giving and receiving of Notices of Non-Payment by email.

(d) The requirements of GC 18.2(b) are of the essence. In order for a Proper Invoice to be considered received by the Region in accordance with the Construction Act, it must be given in accordance with the requirements of GC 18.2(b).

(e) Proper Invoices shall be submitted substantially in the form attached as Appendix A.7.

(f) Proper Invoices must contain, in addition to the information prescribed by section 6.1 of the Construction Act, the following:

(i) Proper Invoice application number

(ii) Contract number and brief description of the Contract

(iii) Purchase Order number

(iv) references to the fax number and e-mail address in the billing contact information

(v) references to item number(s) and item description(s) when describing the services and materials supplied

(vi) a valid WSIB Certificate of Clearance

(vii) a declaration, in the form contained in the form of Proper Invoice attached as Appendix A.7, that all accounts for labour, subcontracts, Products, construction machinery and equipment and other indebtedness which may have been incurred by the Contractor in performing the Work, and for which the Region might in any way be held responsible, have been paid in full except for statutory holdback monies properly retained

(viii) a critical path schedule if requested by the Region

(ix) contemplation, and reflection in the amount payable, of all of the following to the extent they are applicable:

(a) basic holdback

(b) holdback for finishing work

(c) statutory lien holdbacks

(d) maintenance security

(e) applicable taxes

(g) An invoice the Contractor submits which it purports to be a Proper Invoice but which does not meet the requirements of GC 18.2(e) and GC 18.2(f) shall not constitute a Proper Invoice and the Region shall be under no obligation to consider or review such invoice. Invoices submitted by the Contractor shall be considered to be a Proper Invoice, properly received by the Region in accordance with the requirements of the Contract and the Construction Act, unless the Region or the Consultant advises the Contractor otherwise.

18.3 The requirements of GC 18.2 are of the essence.

18.4 The services or materials, including quantity(ies), supplied that are described in a Proper Invoice are not required to be made by strict measurement or with exactness, but may be approximate only.

18.5 The Region and the Consultant shall review the Proper Invoice and advise the Contractor of any disputed amounts in accordance with the Construction Act.

18.6 Provided the Region has not received a claim for lien or written notice of a lien under the Construction Act, the Region shall pay all undisputed amounts to the Contractor in accordance with the provisions of Article A-5 - Payment and the Construction Act.

18.7 The Region reserves the right, in its sole, absolute and unfettered discretion, to permit the Contractor to correct an error in an invoice that the Contractor purported to be a Proper Invoice and gave to the Region. The Region shall be under no obligation to exercise the right conferred to it under this GC 18.7.

18.8 Substantial Performance of the Contract

(a) When the Contractor considers the Contract to be substantially performed, the Contractor shall submit an application for Substantial Performance of the Contract to the Commissioner and the Consultant. The application shall include:

(i) a comprehensive list of all items of work remaining to be completed or corrected. Failure to include an item on the list shall not release the Contractor from its responsibility to complete all items of Work in accordance with the terms of the Contract

(ii) a written declaration, in the form attached as Appendix A.2, confirming that the Contractor is not engaged in, nor aware of, any adjudication and that the Contractor has made reasonable enquiries to confirm this;

(iii) a Preliminary Estimate for Payment covering all work performed up to the date of Substantial Performance of the Contract since the last Proper Invoice submission;

(iv) all outstanding guarantees required pursuant to the Specifications;

(v) all outstanding manufacturers' guarantees covering rated output, efficiency and performance for all operating equipment forming part of the Work;

(vi) complete operating and maintenance instructions for equipment and apparatus furnished under the Contract, and all required record drawings , if not already provided;

(vii) any other documents specified in the Specifications; and

(viii) any other documents reasonably required by the Consultant.

(b) After submitting is application for Substantial Performance of the Contract, the Contractor shall meet with the Region and the Consultant to review and reconcile the value of work performed, deficient work and outstanding work.

(c) Provided the Contract meets the requirements for Substantial Performance of the Contract, the Commissioner shall issue a Certificate of Substantial Performance of the Contract in the prescribed form (the "**Certificate of Substantial Performance**") to the Contractor, specifying the date upon which Substantial Performance of the Contract was attained.

(d) The Contractor shall arrange, at its own expense, for the publication of the Certificate of Substantial Performance in the Daily Commercial News.

(e) The publication of the Certificate of Substantial Performance, as arranged for by the Contractor, shall constitute a waiver by the Contractor of all claims whatsoever against the Region under this Contract up to the date of Substantial Performance of the Contract, whether for a change in the Contract Price, an extension of the Contract Time, or both, except those made in writing prior to the Contractor's application for Substantial Performance of the Contract and still unsettled.

18.9 Release of Basic Holdback

(a) No later than 15 Days following the issuance of the Certificate of Substantial Performance, the Contractor shall submit the following to the Region and the Consultant in accordance with GC 18.2(b):

(i) a Proper Invoice that covers the unpaid work completed up to the date of Substantial Performance of the Contract and which complies with the requirements for a Proper Invoice as specified in GC 18.2(e) and GC 18.2(f):

(ii) proof of publication of the Certificate of Substantial Performance

(iii) a release, in the form attached as Appendix A.1, releasing the Region from all further claims relating to the Contract except for claims for work performed after the date of Substantial Performance of the Contract and claims pursuant to GC 7 - Claims, Disputes and Adjudication made prior to Substantial Performance of the Contract which remain unresolved; and

(iv) a written declaration, in the form attached as Appendix A.2, confirming that the Contractor is not engaged in, nor aware of, any adjudication and that the Contractor has made reasonable enquiries to confirm this.

18.10 The requirements of GC 18.9 are of the essence.

18.11 The Region and the Consultant shall review the Proper Invoice and advise the Contractor of any disputed amounts in accordance with the Construction Act.

18.12 Provided the Region has not received a claim for lien or written notice of a lien under the Construction Act, the Region shall pay all undisputed amounts to the Contractor in accordance with the provisions of Article A-5 - Payment and the Construction Act.

18.13 The Region and the Consultant shall review the documents submitted by the Contractor pursuant to GC 18.9 and advise the Contractor of any amounts of the basic holdback that the Region refuses to pay and shall, in accordance with the Construction Act, arrange for the publication of a Notice of Non- Payment of Holdback in the prescribed form in the Daily Commercial News.

18.14 Provided the Region has not received a claim for lien or written notice of a lien under the Construction Act and provided the time period for preserving any claims for liens for materials or services supplied prior to Substantial Performance of the Contract have expired, the Region shall pay the undisputed amount of the basic holdback to the Contractor in accordance with the provisions of Article A-5 - Payment and the Construction Act.

18.15 Total Performance of the Contract

(a) When the Contractor considers the Contract to be complete, the Contractor shall submit an application for Total Performance of the Contract to the Commissioner and the Consultant. The application shall include:

(i) a comprehensive list of all items of work remaining to be completed or corrected. Failure to include an item on the list shall not release the Contractor from its responsibility to complete all items of Work in accordance with the terms of the Contract

(ii) a written declaration, in the form attached as Appendix A.2, confirming that the Contractor is not engaged in, nor aware of, any adjudication and that the Contractor has made reasonable enquiries to confirm this.

(iii) a Preliminary Estimate for Payment covering all Work performed up to the date of Total Performance of the Contract since the last Proper Invoice submission;

(iv) all outstanding guarantees required pursuant to the specifications;

(v) all outstanding manufacturers' guarantees covering rated output, efficiency and performance for all operating equipment forming part of the Work;

(vi) complete operating and maintenance instructions for equipment and apparatus furnished under the Contract if not already provided;

(vii) all Contractor's record drawings, as built drawings, records and related data;

(viii) all permits, licenses, approvals, certificates and authorizations required by any authority having jurisdiction over the Work or the Place of the Work;

(ix) proof that all claims, including taxes, arising from, or in respect of, the Work and any liens arising from the same which shall have been claimed, filed or recorded have been finally and conclusively satisfied and released;

(x) any other documents specified in the Specifications; and

(xi) any other documents reasonably required by the Consultant.

(b) After submitting its application for Total Performance of the Contract, the Contractor shall meet with the Region and the Consultant in order to review and reconcile the value of work performed, deficient work and outstanding work.

(c) Provided the Contract meets the requirements for Total Performance of the Contract, the Commissioner shall issue a Certificate of Total Performance of the Contract (the "**Certificate of Total Performance**") to the Contractor, specifying the date upon which Total Performance of the Contract was attained. Following the issuance of the Certificate of Total Performance, the Contractor shall promptly execute the Certificate of Total Performance.

(d) The Contractor's execution of the Certificate of Total Performance shall constitute a waiver by the Contractor of all claims whatsoever against the Region under this Contract up to the date of Total Performance of the Contract, whether for a change in the Contract Price, an extension of the Contract Time, or both, except those made in writing prior to the Contractor's application for Total Performance of the Contract and still unsettled.

18.16 Release of Holdback for Finishing Work

(a) No later than 15 Days following the issuance of the Certificate of Total Performance of the Contract, the Contractor shall submit the following to the Commissioner and the Consultant in accordance with GC 18.2(b):

(i) a Proper Invoice that covers the unpaid work completed up to the date of Total Performance of the Contract and which complies with the requirements for a Proper Invoice as specified in GC 18.2(e)and GC 18.2(f);

(ii) a signed copy of the Certificate of Total Performance ;

(iii) a release from the Contractor, in the form attached as Appendix A.3, releasing the Region from all further claims relating to the Contract except for claims for work performed after the date of Total Performance of the Contract and claims pursuant to GC 7 - Claims, Disputes and Adjudication made prior to Total Performance of the Contract which remain unresolved; and

(iv) a written declaration, in the form attached as Appendix A.2, confirming that the Contractor is not engaged in, nor aware of, any adjudication and that the Contractor has made reasonable enquiries to confirm this.

18.17 The requirements of GC 18.16 are of the essence.

18.18 The Region and the Consultant shall review the Proper Invoice and advise the Contractor of any disputed amounts in accordance with the Construction Act.

18.19 Provided the Region has not received a claim for lien or written notice of a lien under the Construction Act, the Region shall pay all undisputed amounts to the Contractor in accordance with the provisions of Article A-5 - Payment and the Construction Act.

18.20 The Region and the Consultant shall review the documents submitted by the Contractor pursuant to GC 18.16 and advise the Contractor of any amounts of the holdback for finishing work that the Region refuses to pay and shall, in accordance with the Construction Act, arrange for the publication of a Notice of Non- Payment of Holdback in the prescribed form in the Daily Commercial News.

18.21 Provided the Region has not received a claim for lien or written notice of a lien under the Construction Act and provided the time period for preserving any claims for liens for materials or services supplied prior to Total Performance of the Contract have expired, the Region shall pay the undisputed amount of the holdback for finishing work to the Contractor in accordance with the provisions of Article A-5 - Payment and the Construction Act.

18.22 Completion of Subcontract

(a) When the Contractor considers a subcontract (the "**Subcontract**") to be complete, and all required inspection and testing of the Work covered by the Subcontract have been finished, the Contractor may submit an application for certification of completion of the Subcontract to the Commissioner and the Consultant.

(b) The application for certification of completion of the Subcontract shall include the following information and documentation with supporting particulars, at a minimum:

(i) a Declaration of Last Supply under subsection 31(5) of the Construction Act from the Subcontractor;

(ii) valid WSIB Certificates of Clearance from the Contractor and the Subcontractor

(iii) a statutory declaration from the Subcontractor, in the form attached as Appendix A.4, that all accounts for labour, subcontracts, Products, construction machinery and equipment and other indebtedness which may have been incurred by the Subcontractor in performing the work under the Subcontract, and for which the Region might in any way be held responsible, have been paid in full except for statutory holdback monies properly retained

(iv) a release from the Contractor and the Subcontractor, in the form attached as Appendix A.5, releasing the Region from all further claims relating to the Subcontract; and

(v) a written declaration, in the form attached as Appendix A.2, confirming that the Contractor is not engaged in, nor aware of, any adjudication and that the Contractor has made reasonable enquiries to confirm this.

(c) Upon receipt of the application for certification of completion of the Subcontract, the Commissioner and the Consultant may, at their sole discretion, review the application to determine whether the Subcontract is complete.

(d) Provided the Subcontract is complete, the Commissioner may issue a Certificate of Completion of Subcontract, in the prescribed form, to the Contractor specifying the date of completion of the Subcontract.

18.23 Proper Invoice for Release of Holdback with Respect to a Completed Subcontract

(a) No later than 15 Days following the issuance of the Certificate of Completion of Subcontract, the Contractor shall submit a Proper Invoice for the release of holdback with respect to a completed Subcontract (the "**Proper Invoice for Subcontract Holdback**") to the Region and the Consultant in accordance with

GC 18.2(b). The Proper Invoice for Subcontract Holdback shall comply with the requirements of GC 18.2(e) and GC 18.2(f).

(b) The requirements of GC 18.23(a) are of the essence.

(c) the Region and the Consultant shall review the Proper Invoice for Subcontract Holdback and advise the Contractor of any disputed amounts.

(d) Provided the Region has not received a claim for lien or written notice of a lien under the Construction Act, the Region shall pay all undisputed amounts under the Proper Invoice for Subcontract Holdback to the Contractor in accordance with the provisions of Article A-5 - Payment and the Construction Act.

(e) Immediately upon receipt of the statutory holdback funds the Contractor shall give to the Subcontractor the payment due under the Subcontract.

18.24 Final Proper Invoice

(a) On a date mutually agreeable to the Contractor and the Region, the Region, the Contractor and the Consultant shall attend a meeting to review and reconcile the final quantities and Work performed and agree upon any adjustments to the Contract Price that may be required (the "**Final Quantity Reconciliation Meeting**").

(b) On the [fourteenth (14th)] Day following the Final Quantity Reconciliation Meeting, the Contractor shall submit to the Region and the Consultant in accordance with GC 18.2(b) a final Proper Invoice that reflects any amounts to be paid by, or credits that are due to, the Region as a result of any required adjustments to the Contract Price (the "**Final Proper Invoice**"). The Final Proper Invoice shall comply with the requirements of a Proper Invoice as specified in GC 18.2(e) and GC 18.2(f).

(c) The Contractor shall submit to the Region, together with the Final Proper Invoice, any other documentation and information that the Consultant reasonably requires.

(d) The requirements of GC 18.24(b) and GC 18.24(c) are of the essence.

(e) The Region and the Consultant shall review the Final Proper Invoice and advise the Contractor of any disputed amounts in accordance with the Construction Act.

(f) Provided the Region has not received a claim for lien or written notice of a lien under the Construction Act, the Region shall pay all undisputed amounts to the Contractor in accordance with the provisions of Article A-5 - Payment and the Construction Act.

18.25 Release of the statutory holdback funds shall not relieve the Contractor, or its surety, from any obligations under this Contract.

18.26 No payment made by the Region under the Contract, or partial or entire use or occupancy of the Work by the Region, nor the fact that the Region did not give a Notice of Non-Payment pursuant to the Construction Act in respect of a Proper Invoice, shall constitute an acceptance of work or Products which are not in accordance with the requirements of the Contract.

18.27 Upon receipt of final payment under the Contract, the Contractor shall be deemed to have expressly waived and released the Region from all claims including, without limitation, those that might have arisen from the negligence or breach of contract by the Region, except those made pursuant to GC 7 - Claims, Disputes and Adjudication prior to the Contractor's submission of the Final Proper Invoice which remain unresolved.

18.28 Notwithstanding GC 2.1, in the event of a conflict between the provisions of GC 18 - Certificates and Payments and Article A-9 - Rights and Remedies, paragraph 9.1, the provisions of GC 18 - Certificates and Payments shall govern.

18.29 The Contractor shall not be entitled to claim, demand or receive any interest as a result of delays in approval or payment by the Region except as expressly permitted under the Construction Act.

18.30 Subject to the Construction Act, any amounts payable to the Region by the Contractor pursuant to the Contract Documents, may be retained out of any monies due, or which may become due, from the Region to the Contractor under the Contract or, if the Contractor becomes insolvent, under any other contract between the Contractor and the Region, and may be recovered from the Contractor or its sureties, or any or either of them, as a debt due to the Region. In addition, the Commissioner shall have full authority to retain monies if circumstances arise which may indicate the advisability of so doing, though the sum to be retained may be unascertained. For greater clarity any amounts payable to the Region by the Contractor pursuant to the Contract Documents, or any deductions, retainage or withholdings the Region is entitled to make pursuant to the Contract Documents, shall entitle the Region to refuse to pay all or any portion of the amounts payable under Proper Invoices on account of such amounts payable, deductions, retainage or withholdings.

18.31 In the event that any portion of the Work is defective or is not performed in accordance with the Contract, the Region may retain as a holdback an amount equal to twice the estimated cost which the Region or the Consultant estimates will be incurred to correct the Work until the Work has been corrected to the satisfaction of the Region. In the event that the Contractor fails to correct/complete the Work to the satisfaction of the Region within 15 Working Days of receipt of written notice of the defective work, the

Region may proceed to correct/complete the Work and shall deduct its costs from the holdback provided for in this provision without further notice to the Contractor.

18.32 In the event that any insurance policy required to be maintained by the Contractor under the Contract has lapsed, or the Region has received notice from the insurer of cancellation of coverage thereunder, the Region may withhold payment until a current certificate of insurance has been provided in a form satisfactory to the Region.

GC 19 Taxes and Duties

19.1 The Contractor shall pay all sales taxes, customs duties and excise taxes with respect to the Contract.

19.2 The prices submitted by the Contractor shall be net of sales taxes and shall include any reduction in the Contractor's operating costs due to rebating of any sales taxes.

19.3 Any increase or decrease in the Contractor's costs due to changes in taxes and duties after the date of the Bid, which were not anticipated at the time of bidding, shall increase or decrease the Contract Price accordingly.

19.4 The Contractor shall submit its claim for an increase to the Contract Price as a result of increased taxes and/or duties prior to Substantial Performance of the Contract.

19.5 The Region reserves the right to make deductions from progress payments in order to compensate for the estimated benefit to the Contractor as a result of decreased taxes and/or duties. Such deductions will be set-off from payments to the Contractor pending receipt of a statement of benefits resulting from a decrease in taxes and/or duties, at which time a final adjustment will be made.

19.6 the Region shall pay to the Contractor Harmonized Sales Tax ("HST") for all work performed under the Contract. The Contractor shall provide the Region with all information and other assistance necessary to enable the Region to obtain any input tax credit to which it may be entitled and, if the Contractor does not do so, the Region may withhold or deduct the equivalent of the benefit of the input tax credit(s) from any amounts otherwise due to the Contractor.

19.7 Subject to GC 19.6, the Region shall pay to the Contractor amounts owing in respect of the HST on the earlier of:

(a) the Day on which payment is made pursuant to GC 18 - Certificates and Payments; and

(b) the last Day of the calendar month immediately after the month in which Substantial Performance of the Contract was attained.

However, no HST is payable in respect of any holdback or retainer amounts until the earlier of:

(c) the date upon which the holdback or retainer becomes due; and

(d) the date upon which it is paid.

GC 20 Laws, Notices, Permits and Fees

20.1 The Contractor acknowledges that the Work is subject to the permits and approvals listed in Article A-3 - Contract Documents and agrees to comply with any and all requirements of those permits and approvals and any other permits and approvals obtained during the course of the Work.

20.2 The Contractor and its Subcontractors shall obtain all necessary permits, approvals, licences and certificates and pay the fees required for the performance of the Work, but this shall not include the obtaining of permanent easements or rights of servitude.

20.3 The Contractor shall give the required notices, and comply with and enforce the laws, regulations, ordinances, rules, codes and orders of the applicable authorities which are in force or come into force during the performance of the Work, including those relating to the Work, the preservation of the public health, the environment and construction safety.

20.4 If it comes to the Contractor's attention that the Contract is not in compliance with applicable laws, ordinances, rules, regulations and codes, and requires modification, the Contractor shall notify the Region and the Consultant in writing requesting direction immediately upon becoming aware of such suspected non-compliance.

20.5 If the Contractor fails to notify the Region and the Consultant in writing and obtain its direction pursuant to GC 20.4, and performs work knowing it to be contrary to any applicable laws, ordinances, rules, regulations, codes and orders, the Contractor shall be responsible for, and correct, the violations thereof, and shall be responsible for all costs, expenses and damages attributable to its failure to comply with the provisions of such laws, ordinances, rules, regulations, codes and orders.

20.6 The Contractor shall, at its own expense, obtain all necessary approvals, consents and permits required for the removal and disposition of excavation material.

20.7 In addition to any other obligation of the Contractor hereunder:

(a) the handling and storage of explosives shall be carried out in accordance with the regulations issued by the Explosives Regulatory Division of Natural Resources Canada; and

(b) work in tunnels or open caissons shall be carried out in accordance with the regulations issued pursuant to the *Occupational Health and Safety Act,* RSO 1990, c O.1.

GC 21 Patent Fees

21.1 The Contractor shall pay all royalties and patent licence fees required for the performance of the Work. The Contractor shall hold the Region, the Consultant, the Local Municipality and their respective directors, officers, council members, partners, agents and employees harmless from and against all claims, demands, losses, costs, damages, actions, suits, and proceedings arising out of the Contractor's performance of the Work which are attributable to an infringement, or an alleged infringement, of a patent or invention by the Contractor, its Subcontractors, agents or assigns.

GC 22 Workplace Safety & Insurance

22.1 Upon execution and delivery of the Contract, prior to commencing the Work and as required in accordance with the terms of this Contract, the Contractor shall provide evidence of compliance with the requirements of the province of Ontario with respect to workplace safety and insurance, including payments due thereunder.

22.2 At any time during the term of the Contract, when requested by the Region, the Contractor shall provide such evidence of compliance by itself and its Subcontractors.

22.3 If the Contractor, at any time, fails to pay any assessment or compensation required to be paid with respect to workplace safety and insurance, the Region may pay such assessment or compensation and charge the cost thereof to the Contractor.

22.4 In the event that the Contractor is a sole proprietor, an Independent Operators Ruling is required. The Contractor shall download the correct form, that corresponds to the classification of work for this Contract, from the Workplace Safety and Insurance Board ("**WSIB**") website, and submit the completed form to the WSIB in order to receive the Independent Operators Ruling. The WSIB ruling must be submitted to the Region prior to commencement of the Work.

22.5 In the event that the Contractor will not be providing a WSIB Certificate of Clearance, Employers Liability insurance coverage in the amount of $5,000,000.00 will be required. Evidence of this coverage shall be provided to the Region on the Region's standard 'Certificate of Insurance' form.

GC 23 Indemnification and Claims Handling

23.1 The Contractor shall indemnify, hold harmless and defend the Region, the Consultant, the Local Municipality and their respective directors, officers, council members, partners, agents and employees from and against all claims, demands, losses, costs (including all legal costs), damages, actions, suits and proceedings that arise directly or indirectly out of, or are attributable to, the Contractor's performance of, or failure to perform, the Work or out of the condition of the Work, the Site, adjoining lands or roadways used in connection with the performance of the Work, including any act or

omission of the Contractor or its agents, any Subcontractors, employees, workers or other persons for whom the Contractor is in law responsible. This indemnification shall include any legal costs incurred by the Region on a substantial indemnity basis, including those incurred to defend any criminal or quasi-criminal prosecutions against the Region resulting from the actions of the Contractor.

23.2 The Contractor shall respond to, and deal with, all third-party claims in a prompt, courteous and efficient manner. The Contractor shall contact all third-party claimants and acknowledge receipt of all third-party claims by telephone within one Business Day, and in writing within three Business Days, upon being notified in writing of the third-party claim. The Contractor shall immediately, upon receipt of any third-party claim, provide the Region's Controllership Office with notice of the third-party claim. The Contractor shall also provide the Region's Controllership Office with copies of all correspondence between the Contractor or its agents and the third-party claimant.

23.3 The Contractor shall not advise the third-party claimant that the Region is responsible for their claim.

23.4 If, in the sole discretion of the Region's Controllership Office, acting reasonably, a claim is not being dealt with in a manner consistent with the provisions of this Contract, which includes, without limiting the generality of the foregoing:

(a) failure of the Contractor to acknowledge receipt of the third-party claim in the manner set out in GC 23.2; and

(b) failure to resolve the third-party claim to the satisfaction of the Region within 90 Days of receipt of the third-party claim;

the Region may appoint an insurance adjuster or other person to settle any third-party claims arising from this Contract. Any money paid by the Region in satisfaction of any third-party claim determined to be the Contractor's responsibility, plus all associated costs incurred by the Region, shall be deducted from monies owing to the Contractor by the Region.

23.5 Notwithstanding GC 23.4 the Region may withhold funds in the amount of any third-party claim received, plus the greater of $1,000.00 or 25% of the amount claimed, from monies owing to the Contractor by the Region under this Contract.

GC 24 Insurance

24.1 Without restricting the generality of GC 23 - Indemnification and Claims Handling, the Contractor shall obtain, maintain, pay the premium(s) and any deductibles for, and provide evidence of, insurance coverage as listed in Schedule A. The insurance shall be taken out with insurance companies licensed to transact business in the Province of Ontario and who are not otherwise excluded by the Region's Risk Manager.

24.2 The forms of the insurance policies shall in all respects be satisfactory to the Region's Risk Manager and shall be maintained continuously from the commencement of the Work until the Work has been completed to the satisfaction of the Region.

24.3 The policies shall be endorsed to provide the Region with not less than 30 Days written notice in advance of any cancellation, change or amendment which restricts coverage such that the Contract requirements are no longer met.

24.4 The Contractor shall provide the Region with proof of insurance, by submitting an original Certificate of Insurance on the Region's standard "Certificate of Insurance" form upon execution and delivery of the Contract, prior to commencement of the Work and thereafter upon request by the Region. In lieu of an original Certificate of Insurance, the Region may accept an electronic copy provided it is e-mailed or faxed by the Contractor's insurance broker directly to the Region.

24.5 If the Contractor fails to provide or maintain insurance as required in this General Condition or elsewhere in the Contract, then the Region may elect to:

(a) withhold payment of funds until a current certificate of insurance or other sufficient evidence has been provided in a form satisfactory to the Region, or

(b) provide and maintain such insurance policies directly and give evidence thereof to the Contractor, Consultant and Local Municipality, as applicable, and all such costs, including administration costs, shall be payable to and recoverable by the Region.

GC 25 Method of Carrying on the Work

25.1 The Contractor shall consult with the Region as to the methods of carrying on the Work, the area(s) for storage of materials and erection of temporary facilities, the area(s) for parking of vehicles, the points of access to the Site, and other information pertinent to the Work, and such consultation shall in no way release the Contractor from its responsibility for such matters pursuant to the Contract.

25.2 No extra charges will be allowed due to the obstructions on the Site incidental to carrying out the Work. The Contractor shall provide temporary bridging, ramps, and other structures as required over excavations, pits, soft spots, grass, and landscaped areas for its own access to undertake the Work, and such temporary structures shall be removed and all damage repaired, all at the expense of the Contractor, prior to completion of the Work.

GC 26 Working Areas

26.1 When deemed necessary by the Region, it shall provide the Contractor with an area(s) designated as working space for construction, storage and access purposes. The Contractor shall confine its operations to these area(s).

26.2 The Region will review and, if acceptable, arrange for any additional working areas which the Contractor may require. Payment for additional areas will be the responsibility of the Contractor.

26.3 In no case shall the Contractor occupy private property without prior written approval from the owner of the private property and the Region.

GC 27 Temporary Buildings

27.1 The locations of temporary buildings to be used for staff and construction purposes, and the type of buildings to be used, must be approved by the Region before work commences.

27.2 Temporary buildings must be kept in a clean and tidy condition so as not to become a danger or nuisance to the adjoining properties.

27.3 When temporary building facilities are no longer needed for the Work, they shall be promptly dismantled, unless otherwise specified or directed, and removed from the Site, and all damage resulting therefrom shall be repaired by the Contractor at its own expense.

GC 28 Temporary Water and Power

28.1 The Contractor shall be responsible for the provision of all temporary water, power and light services required for the performance of the Work. The Contractor shall make all necessary applications, obtain all required permits, and pay all fees and charges for such services and their use.

28.2 Mains operated temporary power and light systems shall be subject to the inspection and approval of the inspection branch of the local hydro authority or other applicable authority.

GC 29 Protection of Work

29.1 The Contractor shall take all precautions to protect the Work against any damage including, but not limited to, the effects of low temperatures, excessive heat or moisture. Should the Contractor fail to adequately protect the Work, all damage and adversely affected portions of the Work shall be promptly repaired by the Contractor to the Region's satisfaction and at no cost to the Region.

29.2 At Regional properties bounded by security fence, the Contractor shall provide auxiliary locks for existing gates and ensure that the gates are open only at times when access to the Site is required. The gates shall be kept closed and locked at all other times.

GC 30 Private Property

30.1 The Contractor shall keep all property owners who may be inconvenienced in any way by the performance of the Work informed of such work by providing at least 48 hours' advance notice. This requirement applies, but is not limited, to cutting off driveways, disrupting services, removing mail boxes or in any way disrupting mail service, temporary drainage problems and encroachment on private property. The Contractor shall also advise the Region of any removal of mail boxes or disruption of mail service in order to permit the Region to notify the postal service.

30.2 All damage to private property shall be immediately brought to the attention of the property owner and the Region with a schedule outlining when, and how, the damage will be repaired.

GC 31 Protection of Property

31.1 The Contractor shall take all precautions to protect the Site, the Region's property, and all property adjacent to, or in, the vicinity of the Site from damage and shall be responsible for any damage which occurs as a result of the Contractor's performance of, or failure to perform, the Work.

31.2 Should the performance or non-performance by the Contractor result in damage to the Site, the Region's property, and/or any property adjacent to or in the vicinity of the Site, the Contractor shall rectify such damage at its own expense. Alternatively, the Region may repair the damage and deduct the costs thereof from any monies owing to the Contractor.

GC 32 Protection of Trees

32.1 The Contractor shall protect all existing trees and other vegetation at, or adjacent to, the Place of Work.

32.2 Unless specified otherwise in the Contract Documents or directed by the Region, any such trees or vegetation which, in the opinion of the Region, have been damaged beyond repair by the Contractor's activities shall be replaced by the Contractor, at its sole expense, with trees or vegetation of a similar size and species, or such other size and species as may be approved by the Region. The replacement trees and vegetation shall be subject to the same period of maintenance as for the Work under the Contract.

GC 33 Protection of Utilities and Adjacent Structures

33.1 The Contractor is responsible for the location and protection of all utilities and underground services within the Site during the performance of the Work.

33.2 The Contractor shall, at its own expense and in a manner approved by the Region, sustain in their place and protect from injury any and all gas mains, public or private sewers and drains, conduits, service pipes, pavement, utility pole lines, overhead wires, telephone lines, cable lines, fences, sidewalks, curbs and all other structures or property adjacent to, or within, the Site, whether over or under ground (the "**Utilities**"). The Contractor shall assume all costs and expenses arising from any damage caused to any of the Utilities as a result of the Work.

33.3 The Contractor shall make all inquiries, and perform all investigations, needed to obtain all required information as to the location of the Utilities. The Region does not ensure the accuracy of any information it furnishes, and the Contractor shall have no basis for any claim against the Region for any damages or extra work caused by relying on such information.

33.4 If a Utility interferes with the performance of the Work, the Contractor shall continue with the Work at another appropriate location until clearance is obtained. If there is no suitable alternate location the Contractor may be required to cease operations temporarily. The Contractor shall not be entitled to any claims for damages or costs arising from such a delay.

33.5 A list of required utility relocations known at the time of tender, if any, is provided in the Supplementary Conditions. The Region does not guarantee the accuracy of the information provided, and the Contractor shall not be entitled to any claims for damages or costs incurred as a result of delays in the Utility relocations.

GC 34 Dust and Paint Particle Control

34.1 The Contractor shall undertake all dust and paint particle control measures to prevent nuisances resulting from any phase of its operation. Dust and paint particle control practices shall be carried out at all locations within, or adjacent to, the Site, or which may be affected by the performance of the Work.

GC 35 Damages and Mutual Responsibility

35.1 If the Region suffers damage in any manner because of any wrongful act or neglect of the Contractor, or of anyone for whom the Contractor is responsible in law, then the Region shall be reimbursed by the Contractor for such damage.

35.2 If the Contractor causes damage to any Other Contractor, the Contractor agrees, upon receipt of notice of the damage, to settle with such Other Contractor by agreement or

arbitration, if such Other Contractor will so settle. If such Other Contractor sues the Region on account of damage alleged to have been so sustained, the Region shall notify the Contractor and may require that the Contractor defend the action at the Contractor's expense. If a final order or judgment against the Region arises therefrom, the Contractor shall pay or satisfy the order or judgment, and pay any and all costs incurred by the Region with respect to the action.

GC 36 Bonds

36.1 On or before the execution of the Contract, the Contractor shall provide to the Region:

(a) a performance bond in the amount of 100% of the Estimated Contract Price in the form called for in the Bid Documents; and

(b) a labour and material payment bond in the amount of 50% of the Estimated Contract Price in the form called for in the Bid Documents.

36.2 Such bonds shall be issued by a surety company licensed under the *Insurance Act, RSO 1990*, c. I.8, as amended, and approved by the Region, and shall be maintained in good standing until the fulfillment of the Contract.

GC 37 Warranty

37.1 The Contractor agrees to promptly correct, at its own expense, all defects and deficiencies in the Work which appear prior to, and during, the warranty period specified in Article A-6 - Warranty Period.

37.2 The Contractor agrees to correct, and pay for, any damage resulting from corrections performed pursuant to GC 37.1.

37.3 Specified warranty periods shall not be construed as limiting the provisions of GC 23 - Indemnification and Claims Handling.

37.4 The Contractor shall, at its own expense, perform replacement work and rectify defects and deficiencies at times convenient to the Region, which may require work outside of normal working hours.

37.5 The remedies of the Region pursuant to this GC 37 - Warranty shall not prevent the Region from taking any action or seeking any right or remedy otherwise available to it for breach of any provisions of the Contract. In addition, the time periods referred to above, or such longer time periods as may be specified elsewhere in the Contract Documents, shall not be construed as a limitation on the time during which the Region may pursue such other action or remedy.

GC 38 Liquidated Damages

38.1 Without prejudice to any other remedy available to the Region, if the Contractor:

(a) fails to complete the Work within the Contract Time, the Contractor shall pay to the Region the amount per Day specified in Article A-7 - Liquidated Damages until the Work is complete; and/or

(b) fails to meet any of the Interim Milestone(s) stipulated in the Contract Documents, the Contractor shall pay to the Region the amount(s) per Day specified in Article A-7 - Liquidated Damages until the Interim Milestone(s) has been met.

38.2 The amounts payable to the Region pursuant to GC 38.1 shall be payable on demand. The Region's failure to demand the amounts payable under GC 38.1 shall in no way waive the Region's right to such payment and the Region shall have the right to refuse to pay all or any portion of amounts payable under Proper Invoices on account of amounts that are payable to the Region under GC 38.1.

38.3 The Contractor acknowledges and agrees that the liquidated damages amounts specified in Article A-7 - Liquidated Damages are a genuine estimate of the actual costs/damages that will be incurred by the Region as a result of the failure of the Contractor to complete the Work, including any Interim Milestone(s), within the allotted time, and is not a penalty.

GC 39 Contractor's Responsibilities and Control of the Work

39.1 The Contractor shall have complete control of the Work and shall effectively direct and supervise the Work so as to ensure compliance with the Contract. The Contractor shall be solely responsible for the construction means, methods, techniques, sequences and procedures and for coordinating the various parts of the Work under the Contract.

39.2 The Contractor shall be solely responsible for construction safety at the Place of the Work and for compliance with the Region's Health and Safety Guide for Construction Contractors, and all rules, regulations and practices of the applicable construction safety legislation.

39.3 The Contractor shall have sole responsibility for the design, erection, operation, maintenance and removal of temporary structures and other temporary facilities and the design and execution of construction methods required in their use. The Contractor shall engage and pay for Professional Engineers skilled in the appropriate disciplines to perform these functions where required by law or by the Contract Documents and, in all cases, where such temporary facilities and their method of construction are of such a nature that professional engineering skill is required to produce safe and satisfactory results.

39.4 The Contractor shall review the Contract Documents and promptly report to the Region and the Consultant any error(s), inconsistency(ies) or omission(s) it discovers. If the

Contractor discovers any error(s), inconsistency(ies) or omission(s) in the Contract Documents it shall not proceed with the affected work until it has received corrected or missing information from the Region or the Consultant. Any additional work necessary due to the Contractor's failure to obtain clarification shall be performed at the Contractor's expense.

GC 40 Quality Control and Quality Assurance

40.1 The Contractor shall ensure that all materials and workmanship meet the requirements of the Contract and shall undertake all quality control testing necessary to determine that the Contract requirements have been met. The Contractor shall provide the Region with copies of all quality control test reports upon request. The Region may randomly test materials and workmanship; however such tests shall not relieve the Contractor of its responsibilities under the Contract.

40.2 Quality assurance testing will only be carried out by the Region after the Region has been notified that an area is ready for testing. If the test results show that the Contract requirements have not been met, the Region will charge the Contractor for the cost of the testing.

40.3 Any charges for testing to be paid by the Contractor shall be based on the testing company's invoice(s) to the Region and will be deducted from any payment owing to the Contractor. Such costs shall include any established lab fee(s) for testing and the technician's time and travel expenses.

40.4 Should any testing reveal a deficiency in the Work, the Contractor shall rectify the deficiency. The Region may, as it deems necessary, reduce or withhold any payments to the Contractor to account for deficient Work.

GC 41 Superintendence

41.1 The Contractor shall appoint a competent supervisor who shall be in attendance at the Site all times that work is being performed, including times when the Contractor's forces are not on the Site and all work is being carried out by Subcontractors.

41.2 The supervisor shall be approved by the Region and shall not be changed except for good reason, and only with the prior written consent of the Region.

41.3 The supervisor shall represent the Contractor at the Site, and instructions given to him by the Region or the Consultant shall be deemed to have been given to the Contractor.

41.4 The Contractor shall also appoint an alternate supervisor, acceptable to the Region, who shall be in attendance at the Site at all times during the performance of the Work when the supervisor is not present.

GC 42 First Aid

42.1 The Contractor shall provide and maintain completely equipped first aid facilities at the Site.

42.2 The first aid facilities shall be maintained in a clean and orderly condition, readily accessible to the Contractor's employees and Subcontractors at all times.

42.3 The Contractor shall designate certain employees, who are properly instructed, to be in charge of first aid. At least one such employee shall be available on the Site at all times that work is being conducted.

42.4 A telephone call list for summoning aid, such as doctors, ambulances, and rescue squads from outside sources, shall be posted in a clearly visible and accessible location on the Site. A detailed plan showing the route(s) to the nearest hospital shall be posted in a clearly visible and accessible location beside the emergency call list. All postings shall be adjacent to the telephone in both the Contractor's and the Region's field offices, if field offices are provided.

GC 43 Labour, Materials and Products

43.1 Unless stipulated otherwise in the Contract, the Contractor shall provide and pay for all labour, materials, Products, tools, construction machinery and equipment, water, heat, light, power, transportation, and other facilities and services necessary for the performance of the Work in accordance with the Contract.

43.2 All Products and materials provided shall be new unless specified otherwise in the Contract. Products which are not specified shall be of a quality best suited to the purpose required and their use. All Products and materials shall be subject to the prior written approval of the Region.

43.3 Unless specified otherwise, all materials and equipment shall conform to the appropriate standard specification requirements of the ASTM and/or the MTO Manual of Designated Sources for Materials.

43.4 The Contractor shall maintain good order and discipline among its employees engaged on the Contract, and shall not employ anyone not skilled in the task assigned to him in connection with the Contract.

43.5 Whenever the Region informs the Contractor, in writing, that any person performing the Work, in its opinion:

(a) is incompetent or disorderly;

(b) interferes with the ability of the Contractor, Subcontractors or Other Contractors to perform work;

(c) carries on an unlawful activity;

(d) acts in a manner inconsistent with the timely completion of the Work;

(e) injures or attempts to injure any person or property;

(f) is not using all reasonable efforts to work safely;

(g) has failed to comply with a direction from the Region or the Consultant, including a direction to stop work; or

(h) acts in a manner that is abusive or offensive to the Region, the Consultant or any member of the public

such person or persons shall be discharged from working on this Contract and shall not be permitted to work on this Contract without the Region's prior written consent.

43.6 If, in the opinion of the Region, the Contractor's workforce, equipment and/or materials, either in number or character, are not adequate or appropriate to carry out all, or any part of, the Work, the Region shall notify the Contractor, in writing. Upon receipt of the notice, and at its own expense, the Contractor shall immediately increase or change its workforce, equipment and/or materials as required in order to ensure compliance with the Contract.

43.7 If the Contractor neglects, or refuses to comply with the written instructions of the Region as to any portion or portions of the Work, the Region may, at its option, proceed to perform the work required, and for that purpose may hire such workers and procure such equipment and materials as may be necessary, and make use of any equipment or materials belonging to the Contractor and which are located at the Site, and all associated expenses will be charged back to the Contractor.

43.8 The Contractor shall ensure that all equipment supplied by it or its Subcontractors, and the suppliers of such equipment, comply with the requirements of the Contract.

43.9 The Contractor shall ensure that all materials supplied under the Contract are compatible with each other, and that any retained existing paints are compatible with the field finish coats.

43.10 The Contractor shall correct, at its own expense, any defective work caused by the non-compatibility of materials.

43.11 The Contractor acknowledges, confirms, represents and warrants to the Region that:

(a) in performing the Work, it shall at all times exercise the degree of care and skill that ought to be exercised by contractors in performing work of the nature contemplated herein; and

(b) it has the necessary experience, skill and expertise required to enable it to fulfill its obligations, duties, liabilities, and responsibilities herein.

GC 44 Equivalents

44.1 The Region's acceptance of a supplier or Product will not constitute approval of the article itself. Items of materials or equipment shall be equal to the specified standard of quality, not only in function, but also in features, details and construction.

44.2 The Contractor, by designating a supplier or Product, will be deemed to have satisfied itself that the supplier or manufacturer whose Product is designated is intending to, is capable of, and will in fact, supply an article that will comply with all requirements of the Contract.

GC 45 Inspection, Rejection and Protection of Materials and Equipment

45.1 Insofar as practicable, testing of materials and equipment may be conducted by the Region before delivery to the Site.

45.2 The Contractor shall submit to the Region, in a form satisfactory to the Region, full information as to materials, equipment and methods which the Contractor proposes to utilize in the performance of the Work.

45.3 In addition, the materials and equipment supplied by the Contractor for the performance of the Work may be inspected by the Region at the time of delivery to the Site and at such other times as the Region may elect. Materials and equipment rejected after delivery to the Site shall be returned to the point of delivery by, and at the sole expense of, the Contractor.

45.4 The Contractor shall provide, at its own expense:

(a) facilities for the handling and inspection of materials and equipment; and

(b) suitable and adequate storage room for materials and equipment during the progress of the Work.

45.5 The Contractor shall be responsible for any loss of, or damage to, materials and equipment until Total Performance of the Contract has been attained.

45.6 The Region's review of any information with respect to the Contractor's choice of materials, equipment and methods shall not release the Contractor from its responsibility for the selection of materials, equipment and methods.

GC 46 Taste/Odour

46.1 The Contractor shall certify that all materials that come into contact with potable water will not introduce toxic substances or produce taste, odour, discolouration or other aesthetic effects in the water and, the Contractor shall obtain approval from the Region before using any paints, epoxies, waterproofing materials, sealants and other similar materials. The Contractor's certification shall include approval from the AWWA, the

federal Food Directorate, MECP, NSF International and/or other agencies approved by the Region.

GC 47 Subsurface Conditions

47.1 The Contractor agrees that it is fully informed regarding all of the conditions affecting work to be done and labour and materials to be furnished for the completion of the Contract, and that this information was secured by personal investigation and research and not from the data received from the Region, the Consultant or their respective representatives.

47.2 The Contractor acknowledges that any data received from the Region was compiled for the use of the Region. No responsibility will be assumed by the Region for the correctness or completeness of the data and should any such data be found to be incorrect or incomplete, the Contractor shall have no claims against the Region.

GC 48 Use of the Work

48.1 The Contractor shall confine its apparatus, the storage of Products, and the operations of its employees to within the limits indicated in the Contract Documents and in accordance with all applicable laws, ordinances and permits, and shall not unreasonably encumber the Site with its Products, construction equipment and machinery.

48.2 The Contractor shall not load, or permit to be loaded, on any part of the Work a weight or force that will endanger the safety of the Work.

GC 49 Cleanup and Final Restoration

49.1 The Contractor shall maintain the Site in a tidy condition, free from the accumulation of waste and debris, during the performance of the Work until the Work has been accepted by the Region.

49.2 The Contractor shall remove all waste and debris that is present at the Site or any adjacent property, including roads and road allowances, during the performance of the Work, and dispose of such waste or debris at a properly authorized waste disposal site. No additional payment will be made for this work, save where such waste or debris is caused by the Region or an identifiable Other Contractor(s).

49.3 The Contractor shall ensure that its truck and equipment operations on all roads are in compliance with the *Highway Traffic Act*, RSO 1990, c H.8, local traffic ordinances and regulations of the local fire, police, traffic and works departments.

49.4 Upon attaining Substantial Performance of the Contract, the Contractor shall remove its surplus Products, tools, construction machinery and equipment not required for the performance of the remaining work and leave the Site in a clean and tidy condition suitable for use by the Region, unless otherwise specified.

49.5 Before the Work is accepted by the Region, all waste, debris and surplus material resulting from the Work shall be removed and disposed of at a properly authorized waste disposal site.

49.6 In general, the Site and all adjacent lands shall be restored to a condition equal to, or better than, the existing conditions at the time immediately prior to the commencement of construction.

49.7 Should the Contractor, in the opinion of the Region, be negligent in its clean up and restoration duties with respect to the Site and any adjacent property, including roads and road allowances, the Region may take all necessary steps to perform such cleaning and charge the Contractor all costs incurred.

GC 50 Cutting and Remedial Work

50.1 The Contractor shall perform the cutting and remedial work required to make the several parts of the Work come together properly.

50.2 The Contractor shall co-ordinate the Work to ensure that this requirement is kept to a minimum.

50.3 Cutting and remedial work shall be performed by specialists familiar with the materials affected and shall be performed in a manner that prevents damaging and endangering the Work.

GC 51 Inspection of the Work

51.1 The Region, the Consultant and their authorized agents or representatives shall have access to the Work at all times. If parts of the Work are in preparation at locations other than the Site, the Region, the Consultant and their authorized agents or representatives shall be given access to such work whenever it is in progress.

51.2 If work is designated for special tests, inspections or approvals in the Contract, by the Region or the Consultant, or pursuant to the laws or ordinances of the Place of the Work, the Contractor shall give the Region and the Consultant timely notice requesting inspection. The Contractor shall arrange for all other inspections and shall notify the Region and the Consultant of the date and time of the inspections in a timely manner.

51.3 If the Contractor covers, or permits to be covered, work that has been designated for special tests, inspections or approvals before such special tests, inspections or approvals are made, given or completed, the Contractor shall, if so directed, uncover such work, have the inspections or tests satisfactorily completed, and make good such work at its own expense.

51.4 The Region or the Consultant may order any part or parts of the Work to be specially examined should it believe that such work is not in accordance with the requirements of

the Contract. If, upon examination, such work is found not to be in accordance with the requirements of the Contract, in the Region's sole discretion, the Contractor shall correct such work and pay for the examination and correction. If such work is found to be in accordance with the requirements of the Contract, the Region shall pay for the examination and replacement.

51.5 The Contractor shall promptly furnish two copies of all required certificates and inspection reports relating to the Work to the Region and the Consultant.

GC 52 Rejected Work

52.1 Defective work, whether the result of poor workmanship, the use of defective Products, or damage through carelessness or any other act or omission of the Contractor or any of its Subcontractors, whether incorporated into the Work or not, which has been rejected by the Region or the Consultant as failing to conform to the Contract requirements, shall be promptly removed from the Site by the Contractor and replaced or re-executed promptly in accordance with the Contract at the Contractor's expense.

52.2 Other Contractors' work destroyed or damaged by such removals or replacements shall be made good promptly at the Contractor's expense.

52.3 If, in the opinion of the Region or the Consultant, it is not expedient to correct defective work or work not performed in accordance with the Contract, the Region may deduct from the monies otherwise due to the Contractor, the difference in value between the work as performed and that called for in the Contract, the amount of which will be determined by the Commissioner.

52.4 The Consultant shall not have any power to waive the obligations of the Contractor under the Contract. No failure or omission of the Region or the Consultant to condemn any defective work or material shall release the Contractor from the obligation to tear out, remove and properly replace the defective work or material upon the discovery of said defective work or material, at the Contractor's expense. In the event that the Contractor refuses or neglects to remove any rejected work or material within 48 hours after receipt of written notice from the Region or the Consultant, such work or material may be removed by the Region at the Contractor's expense.

GC 53 Shop Drawings

53.1 The Contractor shall arrange for the preparation of clearly identified Shop Drawings as called for in the Contract or as requested by the Region or the Consultant, acting reasonably.

53.2 The Contractor shall review all Shop Drawings prior to submitting them to the Region and the Consultant. By this review the Contractor represents that it has determined and verified all field measurements, field construction criteria, materials, catalogue numbers

and similar data and that it has checked and coordinated each Shop Drawing with the Contract requirements. The Contractor's review of each Shop Drawing shall be indicated by the stamp, date, and signature of an individual qualified to make such a determination.

53.3 The Contractor shall submit Shop Drawings to the Region and the Consultant with reasonable promptness and in an orderly sequence in order to avoid a delay in the Work or in the work of Other Contractors. Shop Drawings shall be submitted in the form of reproducible transparencies or prints as directed by the Region or the Consultant. At the time of submission, the Contractor shall notify the Region and the Consultant, in writing, of any deviations in the Shop Drawings from the Contract requirements.

53.4 The Region and the Consultant shall review and return Shop Drawings with reasonable promptness. The Region's and the Consultant's review will be for conformity to the design concept and general arrangement only. Such review shall not relieve the Contractor of its responsibilities for errors or omissions in the Shop Drawings or for meeting all of the Contract requirements unless the Contractor has notified the Region and the Consultant, in writing, of a deviation from the Contract requirements, and such deviation has been specifically approved, in writing, by the Region and the Consultant.

53.5 The Contractor shall make any changes to the Shop Drawings which the Region and/or the Consultant require and resubmit the Shop Drawings unless otherwise directed by the Region and the Consultant. When resubmitting, the Contractor shall notify the Region and the Consultant, in writing, of any revisions other than those requested by the Region and/or the Consultant.

GC 54 Lines and Grades

54.1 Prior to commencing construction, the Contractor shall locate on Site those property bars, baselines and benchmarks that are necessary to delineate the Site and to lay out the Work as shown in the Contract Documents. The Contractor shall notify the Region and the Consultant of the locations of such property bars, baselines and benchmarks so that they may be reviewed by the Region and the Consultant.

54.2 The Contractor shall be responsible for the preservation of all property bars while the Work is in progress, except those property bars which must be removed to facilitate the Work. Any property bars disturbed, damaged or removed by the Contractor's operations shall be replaced under the supervision of an Ontario Land Surveyor, at no additional cost to the Region.

54.3 At no additional cost to the Region, the Contractor shall provide the Region and the Consultant with such materials and devices as may be necessary to review the lay out of the baseline and benchmarks, and as may be necessary for inspection of the Work.

54.4 The Contractor shall provide qualified personnel to lay out and establish all lines and grades necessary for construction. The Contractor shall notify the Region and the Consultant of any layout work carried out, so that it may be reviewed by the Region or the Consultant.

54.5 The Contractor shall install and maintain substantial alignment markers and secondary benchmarks as may be required for the proper execution of the Work. The Contractor shall supply one copy of all alignment and grade sheets to each of the Region and the Consultant.

54.6 The Contractor shall assume full responsibility for the alignment, elevations and dimensions of each and every part of the Work, regardless of whether the Contractor's layout work has been reviewed by the Region and the Consultant.

54.7 All stakes, marks, markers and reference points provided by the Region or the Consultant shall be carefully preserved by the Contractor. In the case of their destruction or removal, such stakes, marks, markers and reference points shall be replaced by the Contractor at no extra cost to the Region.

GC 55 Damage to Survey Stakes, Markers and Bars

55.1 The Contractor shall preserve all survey stakes, markers and iron bars. Any damage to survey stakes, markers and iron bars by the Contractor shall be corrected immediately by the Contractor at its own expense.

GC 56 Owner Supplied Material

56.1 The Contractor shall give the Region not less than 10 Business Days' notice of the time at which material or equipment to be supplied by the Region pursuant to the Contract Documents ("**Owner Supplied Material**") will be required.

56.2 The Contractor shall provide proper storage facilities, and become responsible for the proper care of the Owner Supplied Material from the time of its delivery until incorporated in the Work.

56.3 The Region shall supply, free of costs to the Contractor and free on board to the Site, all Owner Supplied Material. The Contractor shall unload all Owner Supplied Material at the Contractor's own cost. The Region shall not be liable, and no claims shall be made by the Contractor, for loss or compensation on account of delay or failure to provide Owner Supplied Material as a result of circumstances that are beyond the Region's control. The Region will not be responsible for any rental or other charges for handling, hauling or storing Owner Supplied Material or excess Owner Supplied Material ordered by the Contractor for the Work. The full amount of Owner Supplied Material in each shipment must be accounted for by the Contractor, and any theft, loss or damage occurring to the Owner Supplied Material after delivery shall be charged against the

Contractor. Should the Contractor order Owner Supplied Material in excess of the amount necessary to complete the Work, the return freight shall be paid by the Contractor. If the Owner Supplied Material is shipped to another project location, the Contractor shall pay any excess freight charges for direct shipment to such point.

56.4 If Owner Supplied Material arrives at the delivery point in a damaged condition or if there are discrepancies between the quantities received and the quantities shown on the bill(s) of lading, the Contractor shall immediately report such damage or discrepancies to the Region and the Consultant, who shall arrange for an immediate inspection of the shipment and provide the Contractor with a written release from responsibility for such damage or deficiencies. If damage or deficiencies are not so reported, it will be assumed that the shipment arrived in good order and any damage or deficiencies reported thereafter shall be made good by the Contractor at no extra cost to the Region.

56.5 Such Owner Supplied Material or equipment shall remain at the risk of the Contractor who shall be held responsible for the safe keeping of same. The Contractor shall not exercise any act of ownership or control over Owner Supplied Material, or remove any Owner Supplied Material from the Site, or use Owner Supplied Material for purposes other than the Performance of the Work, without written permission from the Region.

56.6 Empty reels, crates, containers and other types of packaging from Owner Supplied Material shall become the property of the Contractor when they are no longer required for their original purpose, and shall be disposed of by the Contractor at its own expense unless specified otherwise in the Contract Documents.

GC 57 Demurrage and Storage

57.1 The Contractor shall be liable for all demurrage and storage charges on shipments containing material for the Work.

GC 58 Protection Against Claims for Labour and Material

58.1 The Contractor covenants and agrees that it will pay, or cause to be paid, all accounts for labour, material, equipment and supplies, together with accounts for equipment rental, accounts for freight incurred and all other supplies furnished, and for all work done under the Contract (collectively, the "**Accounts**"), and it will indemnify, save harmless and defend the Region, the Local Municipality and their respective directors, officers, council members, partners, agents and employees, at all times, from all claims in relation thereto. It is agreed that the Contractor shall furnish the Region with satisfactory evidence that all Accounts have been duly paid, and in case such evidence is demanded by, and not furnished to, the Region, such amount as may in the opinion of the Region be necessary to pay such Accounts may be retained from any monies owed

to the Contractor under the Contract until satisfactory evidence is furnished that all Accounts have been paid in full. The Contractor covenants and agrees that the Region shall have the right, but not the obligation, to pay any Accounts and charge the same to the Contractor, and failing payment thereof the Region may deduct the amounts paid from any monies due, or which may become due, to the Contractor.

58.2 If the Region receives a claim for lien or a written notice of a lien in respect of the Work, in addition to all amounts for which the Contractor may otherwise be liable to pay the Region, and without prejudice to any other remedy available to the Region, the Contractor shall pay to the Region the amount of the lien plus an additional 25% of the lien amount, to be retained as a holdback until the Region is satisfied that all Accounts have been paid in full and any written notice of a lien or claim for lien has been vacated, withdrawn or discharged, as applicable.

58.3 The Region may also require the Contractor to:

(a) vacate or withdraw a written notice of lien; or

(b) vacate or discharge any claim for lien that is registered against title to the lands on which the Place of the Work is located and any adjoining lands

within five Business Days of receipt of the Region's written direction, failing which the Region shall have the right, but not the obligation, to post as security any amounts being held back under GC 58 - Protection Against Claims for Labour and Material in order to vacate, withdraw or discharge the written notice of lien or claim for lien and the Contractor shall also be responsible for the Region's legal costs incurred. In the event that the Region posts security pursuant to this provision the Contractor shall have no claim as against the Region for the monies posted as security.

58.4 The Region shall have the right to pay all arrears, or wages and salaries which are owing to the Contractor's workers or employees for a period of more than one week and deduct the same from the monies due or which may become due to the Contractor. The production of a statutory declaration by any worker or employee setting forth the amount of wage or salary claimed to be due shall be sufficient authority to the Region for the payment of the amount claimed.

58.5 When the liabilities of the Contractor under the Contract exceed the monies owing by the Region, the Contractor or its surety shall pay all such claims as are certified by the Commissioner.

GC 59 Inspection of Books, Payrolls, Accounts and Records

59.1 The Region and/or the MOL shall have the right to audit all books and records (in whatever form they may be kept, whether written, electronic or other) relating or pertaining to the Contract (including any and all documents and other materials, in

whatever form they may be kept, which support or underlie those books and records), kept by, or under the control of, the Contractor including, but not limited to, those kept by the Contractor, its employees, agents, assigns, successors and Subcontractors. The Contractor shall maintain and preserve all original books and records, together with such supporting or underlying documents and materials, for the duration of the Contract and for at least two years following the completion of the Contract, including any and all renewals thereof. The books and records, together with the supporting or underlying documents and materials shall be made available, upon request, to the Region, through its employees, agents, representatives, contractors or other designees, during normal business hours at the Contractor's office or place of business, and the Contractor shall supply certified copies of payrolls and any other records required by the Region as, and when, called for. In the event that no such location is available, then the books and records, together with the supporting or underlying documents and records, shall be made available for audit at a time and location in The Regional Municipality of York, Ontario, which is convenient for the Region.

59.2 GC 59.1 shall not be construed to limit, revoke, or abridge any other rights, powers, or obligations relating to audit which the Region may have by federal, provincial, or municipal statute, ordinance, regulation, or agreement, whether those rights, powers, or obligations are express or implied.

GC 60 Waiver by the Commissioner

60.1 No waiver by the Region, the Commissioner or the Consultant in respect of the performance by the Contractor of any of the provisions, stipulations or agreements contained in the Contract, or in respect of anything shown in the Drawings, shall be of any force or effect unless in writing and signed by the Commissioner, and, in any event, shall not operate as a waiver of any other subsequent default.

GC 61 Trucking

61.1 Where motor trucks used by the Contractor for hauling cause damage to roads, the Commissioner may direct the Contractor, at its own expense, to rectify any damage caused and to use trucks of less weight.

GC 62 Overhaul

62.1 No allowance will be made for overhaul, unless specifically stated in the Contract or approved in writing by the Commissioner.

GC 63 Haul on Materials

63.1 Notwithstanding any other information contained herein, no extra payment shall be made for haul on any material supplied for the Contract, either by the Contractor or the

Region, unless specifically stated in the Contract or approved in writing by the Commissioner.

GC 64 Notices by Contractor

64.1 All necessary notices to utility companies including, but not limited to, waterworks, gas, electricity and telecommunications, and owners or occupants of property, or any other interested parties, shall be given by the Contractor at least 10 Business Days in advance of commencing the related work, except where the serving of such notice is the express duty of the Region. One copy of all such notices shall be provided to the Region. The Region does not undertake to remove poles or other obstructions in advance of the Contractor's work.

GC 65 Compliance with the Occupational Health and Safety Act

65.1 The Contractor acknowledges that it is aware of the provisions of the *Occupational Health and Safety Act*, RSO 1990, c O.1 (the "**OHSA**") and the regulations, policies and guidelines thereunder. The Contractor shall comply with, and cause to be complied with, the provisions thereof as such statutes, regulations, policies and guidelines may be amended or replaced from time to time including, without limiting the generality of the foregoing, all of the obligations of the constructor and employer under the OHSA and regulations, as applicable, in respect of the Work.

65.2 The Contractor shall execute all required documents under the Region's Health and Safety Guide for Construction Contractors at the pre-construction meeting.

65.3 The Contractor shall do, cause to be done, or refrain from doing any act or thing as directed by the Region or the Consultant, including stopping the Work if, at any time, the Region or the Consultant considers that any situation or condition is unsafe or contrary to the provisions of the OHSA, or any other applicable statutes, regulations, policies or guidelines. If the Contractor fails to comply with such direction, the Region may:

(a) take action to remedy the situation or condition and the cost thereof shall be payable by the Contractor on demand and, failing payment thereof, the Region may deduct the costs from monies which are due or may become due to the Contractor; or

(b) terminate the Contract pursuant to GC 6 - Region's Right to Perform the Work or Stop the Work or Terminate the Contract, paragraph 6.2.

65.4 Notwithstanding the foregoing, any act or failure to act by the Region shall not in any way derogate from the responsibility of the Contractor under the Contract, including its obligations under GC 65.1.

65.5 The Contractor shall indemnify and hold harmless the Region, Consultant, the Local Municipality and their respective directors, officers, council members, partners, agents and employees from and against all claims, demands, losses, costs including legal costs, damages, actions, suits or proceedings (including by any government agency) arising as a result of any violation, or alleged violation, of the OHSA or the regulations, policies and guidelines thereunder, as such statutes, regulations, policies and guidelines may be amended or replaced from time to time.

65.6 The Region may employ the services of an occupational health and safety auditor (the "**Auditor**") for the purpose of conducting inspections at the Place of the Work. The Contractor shall grant the Auditor full and unimpeded access to the Site, at all times, and shall immediately comply with any direction issued by the Auditor, the Consultant, or the Region, including any direction to stop work.

65.7 This Contract is deemed to be an individual project for the purposes of the OHSA and the regulations made thereunder and the Contractor acknowledges that it is the "Constructor", as defined in the OHSA, for this project and that it shall carry out all of the obligations, and shall bear all of the responsibilities, of the Constructor as set out in the OHSA and regulations including, but not limited to, the following:

(a) ensuring that the measures and procedures prescribed by the OHSA are carried out;

(b) ensuring that every employer and every worker performing work on the project complies with the OHSA and regulations, and;

(c) ensuring that the health and safety of workers on the project is protected.

65.8 If the Region is designated as the "Constructor" as a result of the Contractor's actions, all of the increases in costs to the Region to carry out the duties and obligations of the "Constructor" shall be borne by the Contractor.

65.9 All OHSA regulations for construction projects shall be strictly adhered to.

65.10 Without limiting the other provisions of GC 65 or the Contractor's obligations for occupational health and safety, the Contractor shall, at no additional cost to the Region, comply with and cause its Subcontractors and any other persons present at the Place of the Work to comply with, all legislative amendments, controls, regulations, requirements and orders that were or are issued by the Government of Canada and the Province of Ontario in response to the global pandemic of the virus leading to COVID-19.

GC 66 Spills Reporting

66.1 Prior to commencing construction, the Contractor shall:

(a) submit to the Region a Spill Action Plan in a form acceptable to the Region, which outlines procedures for the reporting, interception, rapid clean-up, restoration of the affected area, treatment and disposal of the pollutant or substance spilled or discharged and impacted materials including, without limitation, soil, groundwater and vegetation; and

(b) post at the Place of the Work, in a clearly visible and accessible location, a notice containing the following information:

(i) the names and telephone numbers of the representatives of the Region and Local Municipality to be notified in the event of a spill or discharge;

(ii) the telephone number of the Spills Action Centre (1-800-268-6060);

(iii) the names and telephone numbers of the representatives of the fire, police, and health and public works departments of the Local Municipality to be notified in the event of a spill or discharge;

(iv) the names and telephone numbers of companies experienced in the control and clean-up of hazardous and non-hazardous materials and substances that would be called upon by the Contractor in the event of a spill or discharge; and

(v) the name and telephone number of the Contractor's representative responsible for preparing, implementing, directing and supervising the clean-up of a spill or discharge.

66.2 In the event of a spill or discharge into the natural environment, the Contractor shall comply, at all times, with the requirements of the Classification and Exemption of Spills and Reporting of Discharges, O. Reg. 675/98.

66.3 In the event of a spill or other discharge of a pollutant into the natural environment, every person responsible for the emission, or who causes or permits it, must forthwith notify all relevant parties of the spill or discharge. Information reported to the MECP Spills Action Centre must comply with the reporting requirements stated within Classification and Exemption of Spills and Reporting of Discharges, O. Reg. 675/98, and may include the nature of the spill or discharge, the circumstances surrounding the spill or discharge, and the action taken or intended to be taken with respect to the spill or discharge.

Relevant parties to be notified in the event of a spill or discharge may include, but are not limited to:

(a) the MECP Spills Action Centre (1-800-268-6060);

(b) the Region (905-895-1200);

(c) the Local Municipality;

(d) the owner of the pollutant or substance, if known;

(e) the person having control of the pollutant or substance, if known; and

(f) the Consultant

GC 67 Occupancy by the Region

67.1 The Region reserves the right to take possession of, and use, any completed or partially completed portion of the Work provided that the Region does not interfere unreasonably with the Contractor's performance of the Work. Such possession or use shall not be construed as acceptance of the Work or any part thereof and will not affect the Contractor's warranty obligations under the Contract.

GC 68 Compliance with Environmental Legislation

68.1 The Contractor acknowledges that it is aware of the provisions of federal and provincial legislation applicable to the Work and the environment including, but not limited to:

(a) the Clean Water Act, 2006, SO 2006, c 22;

(b) the Conservation Authorities Act, RSO 1990, c C.27;

(c) the Dangerous Goods Transportation Act, RSO 1990, c D.1;

(d) the Endangered Species Act, 2007, SO 2007, c 6;

(e) the Environmental Protection Act, RSO 1990, c E.19;

(f) the *Fisheries Act*, RSC 1985, c F-14;

(g) the Navigation Protection Act, RSC 1985, c N-22;

(h) the Ontario Water Resources Act, RSO 1990, c O.40;

(i) the Safe Drinking Water Act, 2002, SO 2002, c 32;

(j) the *Species at Risk Act*, SC 2002, c 29;

(k) the Technical Standards and Safety Act, 2000, SO 2000, c 16; and

(l) the Transportation of Dangerous Goods Act, 1992, SC 1992, c 34;

and the regulations, permits, approvals, orders, directions, policies and guidelines issued thereunder. The Contractor agrees to comply with, and cause to be complied with, the provisions thereof as such statutes, regulations, permits, approvals, orders, directions, policies and guidelines as may be amended or replaced from time to time including, without limiting the generality of the foregoing, any obligation to obtain, and any terms and conditions of, any approval, permit or other instrument required under the applicable Acts, regulations, policies and guidelines thereunder in respect of the Work

and further agrees to discharge, release, handle, transport, manage, store and dispose of all materials in accordance with such legislation.

68.2 The Contractor shall do, cause to be done, or refrain from doing any act or thing as directed by the Region or the Consultant, including stopping the Work if, at any time, the Region or the Consultant considers that any situation or condition is unsafe, damaging to the environment or contrary to the provisions of the applicable Acts, regulations, policies or guidelines thereunder, or any term or condition of a permit, approval order, directive or other instrument issued thereunder. If the Contractor fails to comply with such direction, the Region may:

(a) take action to remedy the situation or condition and the cost thereof shall be payable by the Contractor on demand and, failing payment thereof, the Region may deduct the costs from monies which are due or may become due to the Contractor; or

(b) terminate the Contract pursuant to GC 6 - Region's Right to Perform the Work or Stop the Work or Terminate the Contract, paragraph 6.1.

68.3 Notwithstanding the foregoing, any act or failure to act by the Region shall not in any way derogate from the responsibility of the Contractor under the Contract including its obligations under GC 68.1.

68.4 The Contractor shall indemnify and hold harmless the Region, the Consultant, the Local Municipality and their respective directors, officers, council members, partners, agents, employees and authorized representatives from and against all claims, demands, losses, expenses, costs including legal and professional costs, damages, actions, suits and proceedings (including by any government agency) arising as a result of any violation or alleged violation of any applicable laws, regulations, by-laws and the common law relating to the environment, including permits, approvals, orders, directions, instructions, authorizations and instruments issued thereunder as such may be amended, replaced or superseded from time to time.

68.5 The Contractor acknowledges that the Region may employ the services of an environmental inspector for the purpose of conducting inspections at the Site. The Contractor shall grant the environmental inspector full and unimpeded access to the Site, at all times, and shall immediately comply with any direction issued by the environmental inspector, the Consultant, or the Region, including any direction to stop work.

GC 69 Approval by the Region

69.1 Whenever in the Contract any matter is subject to the consent, approval, determination, consideration or authority of the Region, or is to be acceptable or to the satisfaction of

the Region, such consent, approval, determination, consideration, authority or determination of acceptability or satisfaction shall be in the sole and absolute discretion of the Region.

GC 70 Non-Resident

70.1 If the Contractor is non-resident in Ontario or Canada it shall obtain a GST/HST Registration Number prior to commencement of the Work.

70.2 The Contractor shall ensure that all Subcontractors whom it proposes to use to carry out any of the Work, and who are non-resident in Ontario or Canada, have obtained a GST/HST Registration Number before they commence any work under the Contract.

GC 71 Right of Set-Off

71.1 Without limiting the specific rights of set-off in favour of the Region provided for in this Contract, the Region shall have the right to set-off against any and all monies due, or which may become due, to the Contractor under the Contract, any amounts necessary to satisfy any liquidated or unliquidated amounts otherwise owing or due and payable by the Contractor to the Region under the Contract, and in the event of the insolvency of the Contractor, in relation to any other contracts between the Contractor and the Region. Without limiting the generality of the foregoing, any rights conferred to the Region under this Contract or at law to set-off against or deduct from monies otherwise owing to the Contractor shall also constitute grounds for the Region to refuse to pay all or any portion of amounts payable under Proper Invoices.

GC 72 Maintenance Security

72.1 the Region may deduct from the maintenance security, if any, any amounts owing to the Region under this Contract, whether the amounts relate to outstanding or deficient Work, or any other claims which the Region may have including, but not limited to, outstanding claims under GC 23 - Indemnification and Claims Handling and GC 58 - Protection Against Claims for Labour and Material.

72.2 The balance of the maintenance security, if any, shall be eligible for release to the Contractor upon the expiration of the warranty period and only after all deficiencies and all other warranty issues have been resolved to the satisfaction of the Commissioner (whether they have occurred during the Warranty Period or thereafter).

GC 73 AODA Compliance

73.1 The Contractor shall ensure that all of its employees, agents, Subcontractors, and others engaged by the Contractor in the performance of the Work receive training in accordance with Sections 7 and 80.49 of Ontario Regulation 191/11 made under the

Accessibility for Ontarians with Disabilities Act, 2005, SO 2005, c.11 (the "**AODA**"). Accordingly, the Contractor shall:

(a) comply with the requirements of the AODA; and

(b) complete and submit to the Region the AODA Training Certificate contained in Appendix A.8 at the time of execution of the Contract or as periodically required by the Region from time to time.

SCHEDULE A – INSURANCE

The Contractor shall obtain, maintain, pay the premium(s) and any deductibles for, and provide evidence of the following insurance coverage, taken out with insurance companies licensed to transact business in the Province of Ontario and who are not otherwise excluded by the Region's Insurance and Risk Manager.

Commercial General Liability Insurance

Commercial General Liability ("**CGL**") insurance with limits of not less than $5,000,000.00 inclusive per occurrence for bodily and personal injury, death, and damage to property including loss of use thereof. Should this policy contain a General Aggregate, the minimum acceptable General Aggregate shall be $10,000,000.00. The CGL insurance shall include Cross Liability and Severability of Interest clauses, Products and Completed Operations coverage (minimum 24 months), Owner's & Contractor's Protective and a Standard Non-Owned Automobile endorsement including standard contractual liability coverage.

The following parties shall be included as Additional Insured parties on the CGL policy:

- the Region
- the Consultant
- the Local Municipality

Automobile Liability Insurance

Automobile liability insurance in respect of licensed vehicles shall have limits of not less than $5,000,000.00 inclusive per occurrence for bodily injury, death, and damage to property. Coverage shall be in the form of a standard owner's form automobile policy providing third party liability and accident benefits insurance and covering licensed vehicles owned and/or leased or operated by or on behalf of the Contractor.

Property Insurance

All Risks Builder's Risk or Installation Floater insurance insuring not less than the sum of the amount of the Estimated Contract Price and the full value of Products that are specified to be provided by the Region for incorporation into the Work. The Contractor and the Region shall be Named Insured's on the policy. This policy shall be maintained from the commencement of the Work until Substantial Performance of the Contract has been attained, as set out in the Certificate of Substantial Performance.

The policies shall provide that, in the event of a loss or damage, payment shall be made to the Region and the Contractor as their respective interests may appear. The Contractor shall act on behalf of the Region and itself for the purpose of adjusting the amount of such loss or damage payment with the insurers. When the extent of the loss or damage is

determined the Contractor shall proceed to restore the Work. Loss or damage shall not affect the rights and obligations of either party under the Contract except that the Contractor shall be entitled to such reasonable extension of Contract Time relative to the extent of the loss or damage as the Region may decide in accordance with GC 5 - Extension of Contract Time.

The Contractor shall be entitled to receive from the Region, in addition to the amount due under the Contract in respect of Work performed prior to the date of the occurrence of the loss or damage, the amount at which the Region's interest in restoration of the Work has been appraised to the extent paid by the insurer, such amount to be paid as the restoration of the Work proceeds and in accordance with the requirements of GC 18 - Certificates and Payments.

The Region will accept in place of the above mentioned insurance coverage, a combination of primary liability limits and umbrella insurance or excess liability limits which meet the CGL, General Aggregate and Automobile Liability limits noted above.

APPENDIX A – FORMS

Appendix A.1	Form of Release to be provided in accordance with GC 18.9 – Release of Basic Holdback
Appendix A.2	Form of Declaration to be provided in accordance with GC 18.8 – Substantial Performance of the Contract, GC 18.9 – Release of Basic Holdback, GC 18.15 – Total Performance of the Contract, GC 18.16 – Release of Holdback for Finishing Work, and GC 18.22 – Completion of Subcontract
Appendix A.3	Form of Release to be provided in accordance with GC 18.16 – Release of Holdback for Finishing Work
Appendix A.4	Form of Statutory Declaration to be provided in accordance with GC 18.22 – Completion of Subcontract
Appendix A.5	Form of Release to be provided in accordance with GC 18.22 – Completion of Subcontract
Appendix A.6	Form of Preliminary Estimate for Payment
Appendix A.7	Form of Proper Invoice
Appendix A.8	AODA Training Certificate

RELEASE

IN THE MATTER OF a contract for _____, known as York Region Contract No. _____, entered into between The Regional Municipality of York (the "Region") and _____ (the "Contractor").

KNOW ALL MEN BY THESE PRESENTS THAT the Contractor, on its own behalf and on behalf of its Subcontractors, and their respective heirs, executors, administrators, successors and assigns, as the case may be (the "Releasor"), for and in consideration of the payment or promise to pay the statutory holdback under the above-mentioned contract, and for other good and valuable consideration, hereby remises, releases and forever discharges the Region and its directors, officers, council members, partners, employees, agents, assigns and successors (the "Releasee"), of and from all manner of actions, causes of action, suits, debts, dues, sums of money, claims and demands whatsoever at law or in equity which the Releasor ever had, now has, or may have by reason of the above-mentioned contract, save and except any claim which the Releasor has arising out of:

1. Claims pursuant to GC 7 – Claims, Disputes and Adjudication made prior to Substantial Performance of the Contract and still unsettled, as listed in the attached "Schedule of Outstanding Claims"
2. The retention by the Region of the maintenance security, if applicable
3. Pending/Unresolved Change Orders as listed in the attached "Schedule of Pending/Unresolved Change Orders"
4. Quantities which have not been finalized

With respect to item 1 above, the Contractor acknowledges and agrees that none of the claims listed in the attached "Schedule of Outstanding Claims" have been admitted, acknowledged or accepted by the Region as valid claims. The Contractor further acknowledges that nothing in this Release prevents or estops the Region from disputing the validity, timeliness and quantum of the claims listed therein.

Dated this _____ day of _____, 20___.

WITNESSED BY: SIGNED, SEALED AND DELIVERED

_____ _____

(Seal)

_____ _____

(Seal)

SCHEDULE OF OUTSTANDING CLAIMS

Description of Dispute	Value of Dispute

SCHEDULE OF PENDING/UNRESOLVED CHANGE ORDERS

C.O. #	Description of Change Order	Value of Change Order

DECLARATION OF NO ADJUDICATION

I, _____
(name)

of _____
(name of Contractor)

declare that:

1. I am the _____ of
(title or position)

_____ ,
(name of Contractor)

and as such have knowledge of the facts herein declared.

2. That _____
(name of Contractor)

entered into Contract No. _____ with The Regional Municipality of York for
(contract no)

_____

_____
(description of contract)

3. That _____
(name of Contractor)

is not engaged in, nor aware of, any adjudication with respect to Contract No. _____ ,
(contract no)

nor is it aware of any adjudication in which any subcontractors or suppliers are engaged, and has made reasonable enquiries to confirm this.

Declared before me in _____
(City/Town)

in the Province of _____ _____
(Province) Signature of Declarant

on the day of , 20

_____
A Commissioner, etc.

RELEASE

IN THE MATTER OF a contract for _____, known as York Region Contract No. _____, entered into between The Regional Municipality of York (the "Region") and _____ (the "Contractor").

KNOW ALL MEN BY THESE PRESENTS THAT the Contractor, on its own behalf and on behalf of its Subcontractors, and their respective heirs, executors, administrators, successors and assigns, as the case may be (the "Releasor"), for and in consideration of the payment or promise to pay the statutory holdback under the above-mentioned contract, and for other good and valuable consideration, hereby remises, releases and forever discharges the Region and its directors, officers, council members, partners, employees, agents, assigns and successors (the "Releasee"), of and from all manner of actions, causes of action, suits, debts, dues, sums of money, claims and demands whatsoever at law or in equity which the Releasor ever had, now has, or may have by reason of the above-mentioned contract, save and except any claim which the Releasor has arising out of:

1. Claims pursuant to GC 7 – Claims, Disputes and Adjudication made prior to Total Performance of the Contract and still unsettled, as listed in the attached "Schedule of Outstanding Claims"
2. The retention by the Region of the maintenance holdback, if applicable
3. Pending/Unresolved Change Orders as listed in the attached "Schedule of Pending/Unresolved Change Orders"
4. Quantities that have not been finalized

With respect to item 1 above, the Contractor acknowledges and agrees that none of the claims listed in the attached "Schedule of Outstanding Claims" have been admitted, acknowledged or accepted by the Region as valid claims. The Contractor further acknowledges that nothing in this Release prevents or estops the Region from disputing the validity, timeliness and quantum of the claims listed therein.

Dated this _____ day of _____, 20___.

WITNESSED BY: SIGNED, SEALED AND DELIVERED

_____ _____

(Seal)

_____ _____

(Seal)

SCHEDULE OF OUTSTANDING CLAIMS

Description of Dispute	Value of Dispute

SCHEDULE OF PENDING/UNRESOLVED CHANGE ORDERS

C.O. #	Description of Change Order	Value of Change Order

DECLARATION OF COMPLETION OF SUBCONTRACT AND PAYMENT OF ACCOUNTS

I, _____ of _____
(name) (name of subcontractor)

declare that:

1. I am the _____ of _____
(title or position) (name of subcontractor)
and as such have knowledge of the facts herein declared.

2. _____ entered into a subcontract with
(name of subcontractor)
_____ for the supply of the following services and/or
(name of contractor)
materials: _____
(description of work)
for York Region Contract No. _____ located at _____
_____
(contract location)

3. The supply of all services and materials required to be furnished under the subcontract have been completed in an acceptable manner.
4. All assessments and levies under the Employment Standards Act, the Workplace Safety and Insurance Act or other social or labour legislation in respect of the subcontract have been duly paid, and the work is free of all liens and encumbrances.
5. All claims for damage to property or injury to persons in respect of the subcontract, and of which the above named subcontractor has received notice, have been fully paid or settled.
6. All accounts for labour, subcontracts, Products, construction machinery and equipment and other indebtedness which may have been incurred by the subcontractor in the performance of the work under the subcontract, and for which the Region might in any way be held responsible, have been duly paid except for statutory and contractual holdback monies properly retained.
7. The above named subcontractor is not engaged in, nor aware of, any adjudication with respect to the above-mentioned subcontract or York Region Contract No. _____ and has made
(contract no)
reasonable enquiries to confirm this.

Declared before me in _____
(City/Town)
in the Province of _____ _____
(Province) Signature of Declarant
on the _____ day of _____ , 20 _____

_____
A Commissioner, etc.

FULL AND FINAL RELEASE

IN THE MATTER OF a subcontract for _____ entered into between _____ (the "Contractor") and _____ (the "Subcontractor") in relation to York Region Contract No. _____ entered into between The Regional Municipality of York (the "Region") and the Contractor, which subcontract has been completed for the price of _____ (exclusive of tax).

KNOW ALL MEN BY THESE PRESENTS THAT the Contractor and Subcontractor, on their own behalf and on behalf of their respective Subcontractors, heirs, executors, administrators, successors and assigns, as the case may be (the "Releasors"), for and in consideration of the payment or promise to pay the statutory holdback in relation to the above mentioned subcontract, and for other good and valuable consideration hereby remise, release and forever discharge the Region and its directors, officers, council members, partners, employees, agents, assigns and successors (the "Releasee"), of and from all manner of actions, causes of action, suits, debts, dues, sums of money, claims and demands whatsoever at law or in equity which the Releasors ever had, now have, or may have by reason of the above-mentioned subcontract, save and except any claim which the Releasors have arising out of:

1. Claims pursuant to GC 7 – Claims, Disputes and Adjudication made prior to the date of completion of the subcontract and still unsettled, as listed in the attached "Schedule of Outstanding Claims"
2. The retention by the Region of the maintenance holdback, if any

With respect to item 1 above, the Contractor and Subcontractor acknowledge and agree that none of the claims listed in the attached "Schedule of Outstanding Claims" have been admitted, acknowledged or accepted by the Region as valid claims. The Contractor and Subcontractor further acknowledge that nothing in this Release prevents or estops the Region from disputing the validity, timeliness and quantum of the claims listed therein.

Dated this _____ day of _____, 20___

WITNESSED BY:

SIGNED, SEALED AND DELIVERED

CONTRACTOR

_____ _____

(Seal)

SUBCONTRACTOR

_____ _____

(Seal)

SCHEDULE OF OUTSTANDING CLAIMS

Description of Dispute	Value of Dispute

PROPERTY SERVICES CONTRACT NO. XXX / YORK REGION PURCHASE ORDER NO. XXX

Brief Description of Contract

CONTRACTOR: *Contractor Name*

Work Period: xxx to xxx

Division XXX

Item No.	Spec.	Description	Unit	Unit Price	Tender Quantity	Tender Amount	Previous Quantity	Current Quantity	Quantity to Date	Previous Amount	Current Amount	Amount to Date	% Complete	Projected Final Quanty	Projected Final Cost	Cost Over/Under
1	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
2	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
3	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
4	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
5	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
6	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
7	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
8	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
9	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
10	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
11	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
12	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
13	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
14	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
15	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
16	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
17	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
18	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
19	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
20	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
21	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
22	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
23	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
24	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
25	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
26	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
27	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
28	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
29	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
					Total				**0**	**$ -**	**$ -**	**$ -**			**$ -**	**$ -**

PROPERTY SERVICES CONTRACT NO. XXX / YORK REGION PURCHASE ORDER NO. XXX

Brief Description of Contract

CONTRACTOR: *Contractor Name*

Work Period: xxx to xxx

Division XXX

Item No.	Spec.	Description	Unit	Unit Price	Tender Quantity	Previous Quantity	Current Quantity	Quantity to Date	Tender Amount	Previous Amount	Current Amount	Amount to Date	% Complete	Projected Final Quanty	Projected Final Cost	Cost Over/Under
30	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
31	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
32	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
33	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
34	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
35	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
36	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
37	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
38	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
39	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
40	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
41	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
42	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
43	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
44	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
45	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
46	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
47	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
48	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
49	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
50	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
51	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
52	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
53	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
54	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
55	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
56	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
57	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
58	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
					Total				**0**	**$ -**	**$ -**	**$ -**			**$ -**	**$ -**

PROPERTY SERVICES CONTRACT NO. XXX / YORK REGION PURCHASE ORDER NO. XXX

Brief Description of Contract

Invoice # xxx
Invoice Date: xxx
Work Period: xxx to xxx

CONTRACTOR: *Contractor Name*
Contractor Address

BILLING CONTACT INFORMATION: *Name, Title*
Phone Number, Fax Number, Email Address
Mailing Address

GST/HST REGISTRATION #: *GST/HST Registration #*

	Tender Amount	Current Amount	Amount Paid	Amount to Date	% Complete
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Division XXX	$0.00	$0.00	$0.00	$0.00	0%
Cash Allowances	$0.00	$0.00	$0.00	$0.00	0%
Change Orders	$0.00	$0.00	$0.00	$0.00	
Credits *(e.g. asphalt payment adjustment)*	$0.00	$0.00	$0.00	$0.00	
Deductions *(e.g. asphalt payment adjustment)*	$0.00	$0.00	$0.00	$0.00	
CONTRACT TOTAL	$0.00	$0.00	$0.00	$0.00	
HST (13%)	$0.00	$0.00	$0.00	$0.00	
TOTAL CONTRACT	$0.00	$0.00	$0.00	$0.00	
Total Value of Work Completed to end of Work Period		$ -	$ -	$ -	
Less 10% Statutory Holdback		$ -	$ -	$ -	
Less 3% Maintenance Security		$ -	$ -	$ -	
Less Lien Holdback		$ -	$ -	$ -	
Subtotal		$ -	$ -	$ -	
Plus HST		$ -	$ -	$ -	
Total amount to be paid to Contractor in accordance with GC...		$ -			

By submitting this invoice, the Contractor declares that:

1. all assessment and levies under the *Employment Standards Act*, the *Workplace Safety and Insurance Act* or other social or labour legislation in respect of this Contract have been duly paid and the work is free of all liens and encumbrances;
2. all claims for damage to property or injury to persons in respect of this Contract for which the Contractor has received notice have been fully paid or settled; and
3. all accounts for labour, subcontracts, products, construction machinery and equipment and other indebtedness which may have been incurred by the Contractor in the performance of the work under this Contract, and for which the Region might in any way be held responsible, have been fully paid except for statutory and contractual holdback monies properly retained, payments deferred by agreement, or payment withheld by reason of legitimate dispute which has been identified to the party or parties from whom payment has been withheld.

PROPERTY SERVICES CONTRACT NO. XXX / YORK REGION PURCHASE ORDER NO. XXX

Brief Description of Contract

CONTRACTOR: *Contractor Name*

Work Period: xxx to xxx

Division XXX

Item No.	Spec.	Description	Unit	Unit Price	Tender Quantity	Tender Amount	Previous Quantity	Current Quantity	Quantity to Date	Previous Amount	Current Amount	Amount to Date	% Complete	Projected Final Quanty	Projected Final Cost	Cost Over/Under
1	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
2	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
3	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
4	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
5	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
6	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
7	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
8	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
9	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
10	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
11	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
12	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
13	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
14	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
15	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
16	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
17	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
18	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
19	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
20	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
21	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
22	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
23	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
24	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
25	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
26	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
27	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
28	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
29	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
					Total				**0**	**$ -**	**$ -**	**$ -**			**$ -**	**$ -**

PROPERTY SERVICES CONTRACT NO. XXX / YORK REGION PURCHASE ORDER NO. XXX

Brief Description of Contract

CONTRACTOR: *Contractor Name*

Work Period: xxx to xxx

Division XXX

Item No.	Spec.	Description	Unit	Unit Price	Tender Quantity	Previous Quantity	Current Quantity	Quantity to Date	Tender Amount	Previous Amount	Current Amount	Amount to Date	% Complete	Projected Final Quanty	Projected Final Cost	Cost Over/Under
30	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
31	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
32	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
33	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
34	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
35	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
36	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
37	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
38	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
39	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
40	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
41	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
42	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
43	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
44	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
45	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
46	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
47	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
48	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
49	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
50	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
51	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
52	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
53	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
54	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
55	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
56	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
57	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
58	spec ref	description	unit	$ -	tender quantity	$ -	0	0	0	$ -	$ -	$ -	0%	0	$ -	$ -
					Total				**0**	**$ -**	**$ -**	**$ -**			**$ -**	**$ -**

AODA TRAINING CERTIFICATE

TO: THE REGIONAL MUNICIPALITY OF YORK (the "Region")

Pursuant to section 6 of *Ontario Regulation 429/07, Accessibility Standards for Customer Service* and Section 7 of *Ontario Regulation 191/11, Integrated Accessibility Standards* (the "**Regulations**"), made under the AODA, the Contractor shall ensure that all of its employees, agents, volunteers, or others engaged by the Contractor in the delivery of goods, services and/or facilities under this Contract receive training in connection with the provision of these goods, services and/or facilities to persons with disabilities. Such training shall be provided in accordance with the Regulations and shall include, without limitation, a review of the purposes of the AODA, the requirements of the Regulations and the *Human Rights Code* as it pertains to persons with disabilities.

The Contractor represents and certifies to the Region that:

1. the AODA training provided by the Contractor includes the following:
   - **a.** A review of the purposes of the AODA, the requirements of the Regulations and the *Human Rights Code*;
   - **b.** How to interact and communicate with persons with various types of disability including persons with disabilities who use assistive devices or require the assistance of a guide animal, or a support person.
   - **c.** How to use equipment or devices that are available on the premises that may assist in the provision of goods and services to a person with a disability.
   - **d.** What to do if a person with a particular type of disability is having difficulty accessing the Contractor's goods or services.
2. the Contractor, its employees, agents, volunteers, and other persons engaged by the Contractor in the provision of goods, services and/or facilities under this Contract have received the required AODA training;
3. the required AODA training is delivered on an ongoing basis, including new employees, agents, volunteers and other persons engaged by the Contractor;
4. the Contractor keeps a record of the training provided and the number of individuals who have received AODA training;
5. under this Contract the AODA training is required by the following number of individuals: _____; and
6. the following number of individuals have received AODA training as of the date of this Certificate: _____.

The source of the AODA training provided by the Contractor is:

- ☐ York Region Accessible Customer Service Training
- ☐ Integrated Accessibility Standards Training
- ☐ Alternate training program that meets the requirements listed above

Signature: _____ **Contractor Name:** _____

Name: _____

Date: _____

APPENDIX B

Health and Safety Guide for Construction Contractors

Human Resource Services – Workplace Health, Safety, Wellness & Benefits Division
Updated: February 2019

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1. Introduction

This Guide is intended to ensure that, pursuant to the *Occupational Health and Safety Act*, the Regional Municipality of York (the "Region") complies with its obligations as Owner and the General Contractor complies with its obligations as Constructor on Construction projects.

This Guide serves as a guideline for bidders to ensure that adequate resources and appropriate measures are utilized to perform the Work safely and to ensure that appropriate procedures are established for monitoring and evaluating health and safety performance.

The purpose of this Guide is to ensure that all Work undertaken by General Contractors is conducted in a manner that:

- Considers and protects the health and safety of York Region residents and members of the public;
- Considers and protects the health and safety of all Workers.

All bidders are required to acknowledge that they have reviewed this Guide and the Pre-Work Hazard Assessment Form. The General Contractor is required to submit a signed copy of the Pre-Work Hazard Assessment Form (template shown at Appendix A) prior to commencing Work.

2. Definitions

***Accessibility for Ontarians with Disabilities Act*:**

The Ontario *Accessibility for Ontarians with Disabilities Act, 2005*, S.O. 2005, c. 11 and its regulations.

Bid Documents:

The documentation issued by the Region in the form of a request for quotation, proposal or tender. Bidders submit their quotes, proposals or tenders in response to Bid Documents.

Competent Person:

A person who:

(a) is qualified because of knowledge, training and experience to organize the Work and its performance,
(b) is familiar with the *Occupational Health and Safety Act* and the regulations that apply to the Work, and
(c) has knowledge of any potential or actual danger to health or safety in the Workplace. (*Occupational Health and Safety Act*, s. 1)

Construction:

The erection, alteration, repair, dismantling, demolition, structural maintenance, painting, land clearing, earth moving, grading, excavating, trenching, digging, boring, drilling, blasting, or concreting, the installation of any machinery or plant, and any Work or undertaking in connection with a project but does not include any Work or undertaking underground in a mine. (*Occupational Health and Safety Act*, s. 1)

Constructor:

A person who undertakes a project for an Owner and includes an Owner who undertakes all or part of a project by himself or by more than one Employer. (*Occupational Health and Safety Act*, s. 1)

Consultant:

The person, firm or corporation, if any, retained by the Region to perform consulting services in relation to the Work.

Contract:

The undertaking by the Region and the General Contractor to perform their respective duties, responsibilities and obligations as prescribed in the Contract Documents and represents the entire agreement between the Region and the General Contractor. The Contract supersedes all prior negotiations, representations or agreements, either written or oral, except to the extent specifically referred to in the Contract.

Contract Documents:

Any documents that form part of the Contract, including any amendments incorporated before the execution of the Contract and any subsequent amendments made pursuant to the provisions of the Contract.

Contractor Safety Specialist:

A person employed or retained by the Region who conducts periodic Site Safety Audits to promote hazard awareness and ensure safe Work practices.

Critical Injury:

An injury of a serious nature that:

(a) places life in jeopardy,
(b) produces unconsciousness,
(c) results in substantial loss of blood,
(d) involves the fracture of an arm or leg, but not a finger or toe,
(e) involves the amputation of an arm, leg or foot, but not a finger or toe,
(f) consists of burns to a major portion of the body, or

(g) causes the loss of sight in an eye.
(*Occupational Health and Safety Act*, Reg. 834, s.1)

Designated Substance:

A biological, chemical or physical agent or combination thereof prescribed as a designated substance to which the exposure to a Worker is prohibited, regulated, restricted, limited or controlled. (*Occupational Health and Safety Act*, s. 1)

Employer:

A person who employs one or more Workers or contracts for the services of one or more Workers and includes a [General] Contractor or Subcontractor who performs Work or supplies services and a [General] Contractor or Subcontractor who undertakes with an Owner, Constructor, [General] Contractor or Subcontractor to perform Work or supply services. (*Occupational Health and Safety Act*, s. 1)

General Contractor:

The person, firm or corporation with whom the Region enters into a Contract as a result of a request for quotation, proposal or tender. The obligations of the General Contractor include those of a Constructor as defined in the *Occupational Health and Safety Act*.

Incident:

An undesired event causing:

(a) personal injury;
(b) no injury, but is described as a near miss or potential for injury; and/or
(c) damage to property or equipment.

***Occupational Health and Safety Act*:**

The Ontario *Occupational Health and Safety Act*, R.S.O. 1990, c. O.1 and its regulations.

Owner:

A trustee, receiver, mortgagee in possession, tenant, lessee, or occupier of any lands or premises used or to be used as a Workplace, or a person who acts for or on behalf of an Owner as an agent or delegate. (*Occupational Health and Safety Act*, s. 1)

In most cases, when the Region procures the services of a Constructor, the Region is considered to be the Owner.

Pre-Work Hazard Assessment Form:

A form which identifies all known hazards existing on the Site at the time the hazard assessment is conducted, including any Designated Substances that may be present on the Site.

Project Administrator/Coordinator:

A person employed by the Region who reports to the Project Manager and is responsible for ensuring that the terms of the Contract are adhered to once the Contract has been awarded to a General Contractor.

Project Manager:

Any person employed by the Region who is responsible for ensuring that the terms of the Contract are adhered to and enforced. A Project Manager may delegate to a Project Administrator/Coordinator.

Site:

The designated site or location of the Work.

Site Safety Audit:

A process performed by the Contractor Safety Specialist to ensure safety compliance that includes, but is not limited to, a visual inspection of the Site, review of relevant documents, and interviews with Workers and representatives of the General Contractor. The results of a Site Safety Audit are produced in a Site Safety Audit Report.

Subcontractor:

A person, firm or corporation having a direct contract with the General Contractor to perform a part or parts of the Work, supply products, or provide a service on behalf of the General Contractor.

Supervisor:

A person who has charge of a Workplace or authority over a Worker. (*Occupational Health and Safety Act*, s. 1)

The Region:

The Regional Municipality of York, its employees, authorized agents and representatives.

Visitor:

Any individual accessing the Site who is not a General Contractor, Subcontractor, Consultant, Worker or representative of the Region.

Work:

The total Construction and related services required by the Contract. Work may include, but is not limited to, the supply of services, labour and materials for the installation, removal, application, demolition, erection, renovation, re-furbishing or construction of a building,

bridge, shaft, tunnel, caisson, trench, excavation, roadway, cofferdam, conduit, sewer, water-main, service connection, duct or well, and other undertakings.

Worker:

A person who performs Work or supplies services for monetary compensation. (*Occupational Health and Safety Act*, s. 1, in part)

Workplace:

Any land, premises, location or thing at, upon, in or near which a Worker works. *(Occupational Health and Safety Act*, s. 1)

Workplace Hazardous Materials Information System (WHMIS):

R.R.O. 1990, Reg. 860 of the *Occupational Health and Safety Act*.

***Workplace Safety and Insurance Act*:**

The Ontario *Workplace Safety and Insurance Act, 1997*, S.O. 1997, c. 16, Sched. A and its regulations.

3. Responsibilities

The Owner shall:

- Conduct a hazard assessment of the Site and provide a copy of the completed Pre-Work Hazard Assessment Form to all bidders.
- Conduct periodic Site Safety Audits and provide a copy of the completed Site Safety Audit Report to the General Contractor to ensure compliance with the *Occupational Health and Safety Act* and with the Contract.

Bidders shall:

- Review the Pre-Work Hazard Assessment Form completed by the Region prior to submitting any bid(s).

General Contractors shall:

- Comply with all of the terms of the Contract.
- Comply with all health and safety requirements under the *Occupational Health and Safety Act* and the *Workplace Safety and Insurance Act*, and ensure that all Workers, Subcontractors and Visitors conduct themselves in a safe manner.
- Acknowledge the appointment of Constructor as defined under the *Occupational Health and Safety Act*.
- Review this Health and Safety Guide for Construction Contractors.

- Ensure all required documentation has been submitted to the Project Manager prior to commencing any Work.
- Disclose any additional hazards located on the Site, apart from those identified on the Pre-Work Hazard Assessment Form, prior to and at any time during Construction activities to the Project Manager and individuals present at the Site.
- Obtain any necessary information regarding the hazards located at the Site and communicate that information to all individuals present at the Site.
- Allow the Contractor Safety Specialist to enter the Site to conduct periodic, unannounced Site Safety Audits to ensure the General Contractor is fulfilling its health and safety obligations under the Contract.
- Understand that the Region may take any action to remedy any contravention of the *Occupational Health and Safety Act*, including stopping unsafe Work or terminating the Contract.

4. Education and Prevention

General Contractors:

All General Contractors must ensure that their employees have completed training regarding all of the hazards associated with the Work, have valid trade certificates and/or licences, and follow established Work procedures.

General Contractors are responsible for ensuring Site safety, including Site access for all persons. Where Region employees require Site-specific training to enter the Site, the General Contractor is responsible for the provision of such training. This may be in the form of a Site induction and/or orientation.

5. Pre-Work Hazard Assessment Form

The intent of the Pre-Work Hazard Assessment Form is to promote hazard awareness and to inform all bidders of any actual hazards that exist or may pose a potential problem during Construction, such as overhead or underground power lines or the presence of asbestos, etc.

The Pre-Work Hazard Assessment Form assists bidders with making informed decisions about the hazards involved and enables them to budget the necessary time and resources to perform the Work safely. The Pre-Work Hazard Assessment Form is a communication tool only and is not intended to be a comprehensive account or analysis of all possible hazards present on the Site.

The Pre-Work Hazard Assessment Form identifies all known hazards existing on the Site at the time of the assessment, including but not limited to the following:

- Electrical/Equipment Hazards
- Physical Hazards
- Chemical Hazards

- Biological Hazards
- Hazardous Conditions
- Public Safety Hazards
- Designated Substances/Other materials

All bidders will be provided with a copy of the completed Pre-Work Hazard Assessment Form. All General Contractors must acknowledge the hazards identified at the time of the hazard assessment and agree, by signing the Pre-Work Hazard Assessment Form, to take every precaution reasonable in the circumstances to protect Workers from those hazards at all times.

6. General Health and Safety Requirements

Separation of Adjacent Construction Projects or Workplaces

The General Contractor is expected to fully cooperate with the Region and its Consultant(s) to ensure a safe separation between two or more Construction projects or Workplaces. To ensure the Owner does not assume the role of Constructor, the General Contractor shall separate the Construction project(s) by space (physical) and/or time (schedule) as per the requirements of the *Occupational Health and Safety Act*.

Public Safety

The Region prioritizes the safety of all persons and the General Contractor must ensure that Work activities do not put members of the public in danger. Ensuring public safety during Construction activities includes but is not limited to:

Site Access:

- Managing Site access with suitable fencing/barriers that physically prevent people from entering the Site and prevent objects or material from unintentionally escaping the Site.
- All materials and equipment shall be stored within the Site perimeter, preferably in secure compounds.
- Prior to leaving the Site at any time, all openings of surfaces, excavations and fall/impalement hazards must be secured/covered and identified.

Signage/Public Awareness:

- The General Contractor shall make the public aware of all hazards. All Sites must have clear signs displayed along the perimeter of the Site and, at any entrance to the Site which is visible to pedestrians, specify the particular hazard(s) and advise that Construction is in progress.

Sidewalks:

- In the event that a sidewalk is within the perimeter of or adjacent to the Site, the sidewalk shall be closed and identified as such well in advance of the closure, and an alternate route shall be provided, even if temporary.
- All sidewalks and paths must be clean and free from debris. Consideration should be given to those individuals with mobility impairments, e.g. those who use wheelchairs.
- Uniform surfaces and ramps shall be provided, as necessary, to comply with the *Accessibility for Ontarians with Disabilities Act*. It is important that the General Contractor ensure that pedestrians are inconvenienced by the Work as little as possible.

Transit Bus Stops:

- In the event that a bus stop is within the perimeter of or adjacent to the Site, it shall be relocated at the direction of York Region Transit.

Vehicles/Equipment:

- The General Contractor must take measures to ensure that vehicles entering and leaving the Site do not hit pedestrians.
- Work areas are to be clearly identified per Ontario Traffic Manual Book 7 and separated from public roadways or walkways, e.g. paths and sidewalks.
- In some situations, as per Ontario Traffic Manual Book 7, it will be necessary for the General Contractor to employ a traffic control person or retain a paid duty police officer(s) to direct traffic and maintain the safe flow of traffic per the *Occupational Health and Safety Act*.

Designated Substances

The Region shall ensure a current Designated Substance Survey (DSS) of the Site is conducted prior to procuring a General Contractor as per the requirements of the *Occupational Health and Safety Act*. The DSS will be a component of the Pre-Work Hazard Assessment and will be provided to all bidders if Designated Substances are present at the Site.

WHMIS and Controlled Materials

In addition to complying with WHMIS, the General Contractor shall inform the Region of the location of controlled substances and materials and shall ensure that these materials are not stored or used on the Site without the Region’s prior approval.

Site Supervisor

As per the *Occupational Health and Safety Act*, the General Contractor shall appoint a Competent Person as the Supervisor of the Site. In the event that the Site Supervisor must temporarily leave the Site for any time period, a designate Site Supervisor must be appointed and must also be a Competent Person.

Stopping Unsafe Work/Stop Work Order

- Region employees are not permitted to direct or instruct Workers on how to perform their regular duties. However, in the event that a dangerous circumstance (as per the *Occupational Health and Safety Act*, s. 44) is observed by the Contractor Safety Specialist or a Region representative, they may intervene and stop the unsafe act or condition from continuing.

- The Region and its Consultant(s) shall have the right to issue warnings and/or to stop Work if the General Contractor violates the *Occupational Health and Safety Act* or any health and safety requirement of the Contract.

- A written stop work order will be issued when imminent danger is identified or where significant damage to equipment or property or environmental degradation could occur if the unsafe act or condition continues.

- Stop work orders only involve those areas of the Site immediately concerned in the identified hazardous situation and are to be included in the order.

- Written warnings and/or stop work orders shall be provided to individuals representing the General Contractor and the Region.

- Work may not resume until the Region is satisfied that the imminent danger is eliminated. Notification to restart Work will be made to all parties advised of the original stop work order.

- The Region reserves the right to have a hazard eliminated at the expense of the General Contractor.

Reporting Incidents and Ministry of Labour Visits

The General Contractor shall:

- Immediately investigate all Incidents and immediately report the Incidents to the Project Manager and/or Ministry of Labour (if required). This includes all Critical Injuries, fatalities and those Incidents prescribed under Sections 11 and 12 of Regulation 213/91 of the *Occupational Health and Safety Act*.

- Provide proof of Incident investigation to the Project Manager for any Incidents that occurred on the Site.

- Notify the Region and its Consultant(s) of any report issued by the Ministry of Labour. All documentation, including investigation reports, Site visit reports and/or orders issued, shall immediately be forwarded to the Region and its Consultant(s).

7. Site Safety Audits

York Region Site Safety Audit Process

- The Contractor Safety Specialist may arrive at the Site unannounced and will report to the Site Supervisor.

- If available, the Site Supervisor or Site health and safety representative will accompany the Contractor Safety Specialist to perform a Site walkthrough to conduct a Site Safety Audit.

- If any deficiencies are noted or Workers are observed not to be performing their duties in a safe manner, the Site Supervisor will remedy any deficiencies and/or direct the Workers to perform their duties safely.

- In the event that the Site Supervisor or their designate is unavailable, the Contractor Safety Specialist will conduct the Site Safety Audit on their own.

- In the event that a dangerous circumstance is observed by the Contractor Safety Specialist, they will intervene and stop the unsafe act or condition from continuing and a written stop work order will be issued.

- The Contractor Safety Specialist will not direct Workers on how to perform their regular duties.

- All observations and recommendations will be documented in the Site Safety Audit Report (template shown at Appendix B).

- The Site Safety Audit Report will be sent by email to individuals representing both the General Contractor and the Region, including Consultants and Project Administrators.

- The General Contractor must review all concerns and comments, if any, made on the Site Safety Audit Report and take appropriate action(s) to immediately address and/or correct the concerns and comments.

- After corrective action is taken, the General Contractor must advise all parties who received the Site Safety Audit Report in writing of the specific actions that were taken to correct the deficiencies.

Consultant Site Safety Audit Process

- In addition to the Contractor Safety Specialist conducting Site Safety Audits, the Consultant may conduct periodic inspections of the Site to ensure health and safety compliance. Inspections may include visual inspections as well as testing and sampling, as required.

The General Contractor shall be responsible for any and all costs associated with delays as a result of the General Contractor's failure to comply with the health and safety requirements outlined in the Contract.

The General Contractor shall immediately address any non-compliance issues identified by the Consultant and shall provide the Consultant with a written report of action(s) taken to correct non-compliance of health and safety issues identified.

The Consultant may stop the Work if non-compliance of health and safety regulations is not corrected.

The Region and its Consultant shall have the right to document all health and safety concerns regarding the General Contractor's health and safety compliance.

8. Program Review

The Region will review this Guide and make amendments as required.

9. Non-Compliance

The Region does not tolerate or condone unsafe Work procedures. The failure of a General Contractor to comply with this Guide may result in the Region stopping the Work, terminating the Contract, and/or the General Contractor being subject to penalties, including but not limited to those set out in the *Occupational Health and Safety Act* and the *Workplace Safety and Insurance Act*.

10. Applicable Regulations and References

Occupational Health and Safety Act, R.S.O. 1990, c. O.1

Workplace Safety and Insurance Act, 1997, S.O. 1997, c. 16, Sched. A

Ontario Traffic Manual Book 7 (OTM) 2014

Edwards, C. & Conlin, R. *Employer Liability for Contractors Under the Ontario Occupational Health and Safety Act*, *2nd Edition.* 2007 Thomson Carswell, Toronto, ON.

11. Appendices

A – Pre-Work Hazard Assessment Form
B – Site Safety Audit Report

Appendix A

Pre-Work Hazard Assessment Form

This Pre-Work Hazard Assessment Form is a field observation of the physical conditions existing at the proposed work location as at the time of the hazard assessment. The intent of this form is to promote hazard awareness and incident prevention, and to inform all bidders/General Contractors of any existing hazards that may pose a potential risk during work activities. This form is a communication tool only and is not intended to be a comprehensive account or analysis of all possible and potential hazards present at the work site.

Name of Project Manager:	Project Number:
Name, Title and Organization of person performing assessment:	
Proposed Work Location:	Assessment Date:
Description of Proposed Work:	Assessment Time:

Identify **all** known hazards existing at the time of the hazard assessment. Check off if applicable ☑

ELECTRICAL/EQUIPMENT		BIOLOGICAL	
Overhead wires/lines		Increased risk of mould proliferation	
Live systems or high voltage equipment		Bird or bat droppings	
Overhead crane (**must** be re-certified before use)		Rodent or insect infestation	
Moving equipment (e.g. drive shafts, belts, gears)		Wildlife	
PHYSICAL		Contaminated sharps, syringes, broken glass	
Fire/explosion risk		Sewage, sludge, biohazards	
Heat		HAZARDOUS CONDITIONS	
High noise levels		Working at heights	
Vibration		Water/drowning/flooding	
High pressure or compressed air systems		Slip/trip hazards and uneven footing	
Indoor air quality issues (e.g. fumes, mists, dusts)		Excavation/ditch/culvert	
Non-ionizing radiation (e.g. UV, IR, radio frequency or lasers)		Concealed/buried services in ground OR in structure walls/floors (e.g. conduit, pipe, hydro, gas, water)	
Sufficient lighting and visibility of all work areas		Confined Space (Provide Confined Space Assessment)	
CHEMICAL		Is PPE required to enter the work area?	
Existing products in use e.g. chemicals, lubricants, solvents, treatments (Provide Safety Data Sheets)		Are site specific rescue plans required for the area?	
		Traffic, railway and active roadway nearby	
Fuels (e.g. gasoline, diesel, natural gas, propane)		PUBLIC SAFETY	
Chemicals stored in approved cage/cabinet/room		Does the public have access to the work area?	
Explosion proof or grounded containers		Is the work area at/near a public transit stop?	
Compressed gas cylinders		Is there a history of violent/behavioural incidents?	
DESIGNATED SUBSTANCES/OTHER MATERIALS		OTHER	
Note: A Designated Substance Survey (DSS) **must** be completed when a designated substance is present in the work area		Are other contractors/services entering the work area (e.g. snow clearing, landscaping, deliveries, hauling)? If yes, contact Property Services Branch	
Asbestos (e.g. walls, tiles, pipe insulation, coatings)		Is a security system currently in use?	
Lead (e.g. paint)		List others/comments:	
Mercury (e.g. thermostats, switches, bulbs)			
Silica (e.g. concrete blocks, mortar, bricks, floors)			
PCB's (e.g. light ballasts, transformers, capacitors)			
Ozone depleting substances (e.g. coolants)			
Contaminated soil or water (e.g. oil, waste)			

All bidders/General Contractors shall release and hold harmless York Region, its consultants, the local municipalities and their respective directors, officers, agents and employees from and against any claims, demands, losses, costs, damages, actions, suits or proceedings (including by any government agency) arising as a result of any omissions, misrepresentation, inconsistencies, or errors in the information or content stated in this form.

All General Contractors must:

- Advise anyone who may be affected of any additional hazards located on site prior to and at any time during work activities
- Visit the proposed work location (if possible) to become familiar with the surroundings and any potential hazards that may be present
- Understand that in the event of any conflicts, the requirements of *Occupational Health and Safety Act* and its regulations take precedence over any requirements of the contract or any directions provided
- Ensure that training is provided to their employees and/or subcontracted employees to perform work based on the hazards identified in this form
- Comply with all requirements under the *Occupational Health and Safety Act* and its regulations
- Sign this form to acknowledge the hazards and conditions identified as existing at the time of this assessment, prior to the commencement of any work on site.

To be completed by General Contractor

By signing this form, I acknowledge, as the Authorized Representative of the General Contractor, the hazards outlined above in this Pre-Work Hazard Assessment Form and agree to take every precaution reasonable in the circumstances to protect employees, subcontractors, visitors and the public from those hazards at all times.

(Please Print)

Name of General Contractor: _____

Name and Title of Authorized Representative: _____

Signature of Authorized Representative: _____

Date: _____

Note: All shaded areas must be completed prior to commencing work.

Appendix B

SITE SAFETY AUDIT REPORT

Name or Location of Project:	Audit Date:	Time In:	Time Out:
Project Manager (General Contractor):	Project Manager (York Region):	Project Manager (Consultant):	
Site Supervisor (General Contractor):	Project Number (York Region):	Auditor (York Region):	
Description of Project Activity:			

Item *(☑ - Items Audited)*	Comments/Observations
☐ Site Supervisor present/available onsite	
☐ Notices/permits/reports/regulations posted	
☐ Emergency Preparedness/Fire Safety	
☐ Site Orientation/Safety Meetings	
☐ Site Hazards Identified & Communicated	
☐ Site Conditions/Housekeeping & Hygiene	
☐ Equipment/Machinery Use and Condition	
☐ Chemical Handling/Materials Handling	
☐ Access/Egress	
☐ Scaffolds and Work Platforms	
☐ Fall Prevention/Protection	
☐ Protective Clothing, Equipment & Devices	
☐ Confined Spaces	
☐ Excavations	
☐ Underground Locates (Utilities)	
☐ Electrical Hazards	
☐ Traffic Control	
☐ Other hazards:	

☐ Site Supervisor informed verbally	Auditor Comments:
Site Representative (Contractor/Constructor):	Action is required for Comments/Observations (#) to (#). Please advise the Project Manager in writing when the required actions are taken.
Project Manager (Client/Owner):	

This Site Safety Audit Report represents a brief observation of the physical conditions of the project site. The intent of the report is to promote hazard awareness and/or alert the General Contractor to items that may result in injury or illness to workers, the general public, or other personnel and/or damage to property or equipment.

This Site Safety Audit Report is not intended to be a complete or comprehensive report of all occupational health and safety contraventions present on the site and is not intended to identify all occupational health and safety requirements that the General Contractor must comply with under the *Occupational Health and Safety Act* and its regulations. This Site Safety Audit Report does not, in any way, diminish or otherwise affect a General Contractor's duties and obligations as a Constructor pursuant to the *Occupational Health and Safety Act*.

SUPPLEMENTARY CONDITIONS

SC 1 OTHER CONTRACTORS

Other work may be in progress within, and/or adjacent to, the Site, including the following:

- A separate Regional contract for exterior window replacement at the York Region Administrative Centre. It is anticipated that the window replacements on the 3rd floor will take place between April and September, 2021 during the hours of 7:00 a.m. and 4:00 p.m.

The Contractor shall provide a minimum of 6 feet of clearance between its equipment and materials and the windows.

The Contractor shall coordinate its work with the work of Other Contractors and shall not restrict access to the working areas or operations of the Other Contractors.

The Contractor shall maintain a separation of time and space from Other Contractors to ensure that the Owner is not placed in the position of "Constructor" within the meaning prescribed in the *Occupational Health and Safety Act*, RSO 1990, c O.1 and shall comply with all other requirements stipulated in GC 9 – Other Contractors. No extension of Contract Time and/or an Increase to the Contract Price will be granted for delays resulting from this construction coordination.

SC 2 OPERATIONAL CONSTRAINTS

The Contractor shall undertake the Work in accordance with the following operational constraints:

- No work can be conducted between the hours of 8:00 a.m. EST and 4:30 pm EST, Monday through Friday. Work can commence anytime on Saturday and Sunday
- The Contractor shall provide the Region with a minimum of 72 hours' notice when working on the sprinkler systems. No sprinkler work is permitted to take place on Fridays or weekends. The drain down and fill up of the sprinkler system can only occur at 7:30 a.m. EST.
- Parking is only allowed at designed parking spots at the Administrative Centre.
- The use of Elevator 1 when transporting large building maters such as gypsum board and metal studs can only be used only between 5:30 p.m. EST to 7:00 a.m. EST (the following day)
- Exterior windows will be being replaced by an Other Contractor. The Contractor shall provide a path for the window replacement contractor through its work area to the area in which the windows are being replaced and shall provide a minimum of 6 feet of clearance between its equipment and materials and the windows.

Demobilization/Remobilization from Site for Furniture Installation

- The Contract Time will be suspended after the Contractor has achieved Substantial Performance of the Contract, for a period of 20 Working Days to allow for furniture installation by the Owner. Once Substantial Performance of the Contract has been achieved, the Contractor shall demobilize from the Site, which includes removal of all construction materials, tools, site office, and staff members. Once furniture installation has been completed, the Contractor shall re-mobilize and return to the Site to complete final connection for the workstations which requires power pole. Any costs associated with this Supplementary Condition, including demobilization, remobilization, delay and/or coordination costs, are included in the Contract Price and no additional compensation will be paid to the Contractor.

Additional Site Visits For Altos Installation Subcontractor

The scope of work for the Altos Installation Subcontractor includes the following site meetings:

- three meetings with the supplier and the Owner on site to review the scope of work prior to installation
- two site meetings to inspect the installation and resolve deficiencies.

SC 3 PENDING PERMITS AND APPROVALS

The Owner is in the process of obtaining the following permits and approvals for the work described below:

- Building Permit from the Town of Newmarket

Copies of the permits and approvals will be provided to the Contractor once they have been obtained. The permits and approvals will form part of the Contract Documents and the Contractor shall comply with the requirements of all permits and approvals at no additional cost to the Owner.

The Contractor shall not commence any work for which a permit or approval is required until such time as the permit or approval has been obtained by the Owner and provided to the Contractor.

In the event that the Owner encounters delays in obtaining the permits and approvals, any work for which a permit or approval is required may be deleted from the scope of Work under the Contract, or the Contract may be terminated in its entirety. The Contractor shall not have any claims for delays, on the part of the Owner, in obtaining the permits and approvals, or any claims in the event that any work is deleted from the Contract or the Contract is terminated because a required permit or approval has not been obtained by the Owner.

SC 4. SUBSTANTIAL PERFORMANCE OF THE CONTRACT

The Work will not be deemed to be ready for use or being used for the purposes intended pursuant to section 2 of the Construction Act until the following conditions have been met at a minimum:

- each item of mechanical, electrical, instrumentation, piping and HVAC equipment installed under this Contract has been tested to demonstrate compliance with the performance requirements of this Contract;
- each mechanical, electrical, instrumentation, piping and HVAC system installed or modified under this Contract has been tested in accordance with the specified requirements;
- the Work has satisfactorily passed all required inspection and performance testing;
- all test results have been submitted to the Owner;
- all operating manuals, maintenance manuals, and "As-Built" drawings have been completed and submitted to the satisfaction of the Owner;
- all training required under the Contract has been completed and instructions have been provided to the Owner's staff to enable the Owner to operate the facility; and
- all spare parts and materials have been supplied; and
- all warranty certificates have been submitted

No deviations from these requirements will be permitted.

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*22 42 03	PLUMBING FIXTURES
*23 03 13	ELECTRIC MOTORS
*23 05 01	ELECTRIC WIRING FOR MECHANICAL
*23 05 10	HYDRONIC PIPING
*23 05 14	MOTOR STARTERS
*23 05 15	HYDRONIC SPECIALTIES
*23 05 20	HORIZONTAL FAN COIL UNITS
*23 05 29	SUPPORTS AND ANCHORS
*23 05 48	VIBRATION ISOLATION

*23 05 53	MECHANICAL IDENTIFICATION
*23 05 93	TESTING, ADJUSTING, BALANCING, COMMISSIONING
*23 07 13	DUCT INSULATION
*23 07 15	INSULATION SCHEDULES
*23 07 20	PIPING INSULATION
*23 08 00	HVAC SYSTEM COMMISSIONING
*23 31 10	LOW PRESSURE DUCTWORK
*23 33 00	DUCKWORK ACCESSORIES
*23 33 14	BALANCING DAMPERS
*23 33 16	FIRE DAMPERS
*23 33 46	FLEXIBLE DUCKWORK
*23 33 53	ACOUSTIC DUCT LINING
*23 37 13	GRILLES, REGISTERS, & DIFFUSERS
*25 00 00	CONTROLS
*25 08 00	INTEGRATED AUTOMATION COMMISSIONING
	ELECTRICAL TABLE OF CONTENTS
*26 01 00.00	OPERATING AND MAINTENANCE INSTRUCTIONS
*26 05 01.00	GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS
*26 05 02.00	DEFINITIONS AND ABBREVIATIONS
*26 05 03.00	RECORD DRAWINGS
*26 05 04.00	SUBMITTALS SHOP DRAWINGS
*26 05 05.00	MOUNTING HEIGHTS
*26 05 21.00	WIRES AND CABLES 1000V
*26 05 26.00	GROUNDING AND BONDING
*26 05 29.00	HANGERS AND SUPPORTS
*26 05 31.00	SPLITTER JUNCTION PULL BOXES AND CABINETS
*26 05 32.00	OUTLET BOXES CONDUIT BOXES AND FITTINGS
*26 05 34.00	CONDUIT, CONDUIT FASTENERS AND FITTINGS
*26 05 53.00	IDENTIFICATION
*26 05 63.00	ACCESS DOORS AND ACCESSIBILITY
*26 05 88.00	CUTTING AND PATCHING
*26 08 00.00	ELECTRICAL SYSTEMS COMMISSIONING
*26 24 17.00	PANELBOARDS – BREAKER TYPE
*26 27 26.00	WIRING DEVISES
*26 28 14.00	FUSES LOW VOLTAGE
*26 28 21.00	MOULDED CASE CIRCUIT BREAKERS
*26 28 23.00	DISCONNECT SWITCHES – FUSED AND NON-FUSED
*26 51 13.00	LIGHTING EQUIPMENT
*28 31 03.00	MULTIPLEX FIRE ALARM AND VOICE COMMUNICATION SYSTEM
	COMMUNICATION TABLE OF CONTENTS
*27 00 05.10	GENERAL INSTRUCTIONS FOR COMMUNICATIONS SECTIONS
*27 00 05.20	DEFINITIONS AND ABBREVIATIONS
*27 00 05.30	CODES, STANDARDS AND REGULATIONS

*27 00 05.50	CONTRACT DOCUMENTS
*27 00 05.60	ADMINISTRATIVE REQUIREMENTS
*27 00 05.70	PROJECT SPECIFIC REQUIREMENTS
*27 00 06.00	FIRE STOPPING AND WATER PROOFING
*27 00 07.00	CABLE AND EQUIPMENT REMOVAL
*27 05 28.00	PATHWAYS FOR COMMUNICATION SYSTEMS
*27 05 53.00	IDENTIFICATION FOR COMMUNICATION SYSTEMS
*27 08 00.00	COMMISSIONING FOR COMMUNICATION SYSTEMS
*27 11 19.00	COMMUNICATION TERMINATION BLOCKS AND PATCH PANELS
*27 11 23.00	COMMUNICATION CABLE MANAGEMENT AND LADDER RACK
*27 15 00.19	DATA COMMUNICATION HORIZONTAL CABLING
*27 15 33.00	COMMUNICATIONS COAXIAL HORIZONTAL CABLING
*27 15 43.00	COMMUNICATION FACEPLATES AND CONNECTOTS
*27 16 13.00	COMMUNICATION CUSTOM CABLE ASSEMBLIES
*27 16 19.00	COMMUNICATION PATCH CORDS AND CROSS CONNECT

LEGEND

* Specifications prepared by Consultants other than G. Bruce Stratton Architects have been prefixed with an asterisk. These Specifications are not included under, nor governed by G. Bruce Stratton Architects' seal.

Consultant's Abbreviations:

GBS	G. Bruce Stratton Architects	Architectural
GPY	GPY + Associates	Mechanical
S+A	Smith and Andersen	Electrical and Communication

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to this Section.

1.2. SPECIFICATION FORMAT

1.2.1. Specifications are addressed to the Contractor. Specifications are not intended as detailed description of installation methods but serve to indicate particular requirements in completing the Work.

1.2.2. Where the Contract Documents do not provide sufficient information for complete installation of item, then as supplement, comply with manufacturer's written instructions for quality of work.

1.2.3. Portions of the Specifications are written in short form. Therefore, it shall be understood that where item of the Work is stated in heading followed by material, equipment, component, or operation, words "shall be", "shall consist of" or similar words or phrases are implied which denote supply, fabricate and supply, install, provide or commission of such materials, equipment or operations for component of the Work designated by heading.

1.2.4. Where items in the Contract Documents are referred to in singular, provide as many as required to complete the Work. Words used in one gender only shall mean females as well as males and conversely.

1.2.5. Drawings, Lists or Schedules of Items are intended to show scope and arrangement of the Work. For location of item described refer to such Drawings, Lists or Schedules unless location stipulated in the Specifications.

1.3. DEFINITIONS

Refer to the Definitions set out in the Contract Documents between the Owner and Contractor as amended by the Owner.

1.4. DISCREPANCIES/CONFLICTS/OMISSIONS

1.4.1. If discrepancies or conflicts in, or omissions from the Drawings, the Specifications or other Contract Documents are suspected, or if there is doubt as to meaning or intent thereof, notify the Consultant at once. Where there is conflict between the Contract Documents, the most stringent requirement shall prevail.

1.4.2. The Drawings, Specifications and other Contract Documents are intended to be in compliance with federal, provincial and municipal laws, by-laws, regulations and other requirements of authorities having jurisdiction. Perform work in conformity with such requirements. If discrepancies, conflicts or omissions are suspected, notify the Consultant at once.

1.4.3. Comply with the Consultant's written instructions or explanations.

1.4.4. Promptly and not later than within 10 Working Days of becoming aware of circumstances which may require a change in the Work or other directions, give written notice to the Consultant outlining such circumstances and request written directions. Do no work in affected area, or that would prevent the Consultant from properly assessing situation or evaluating change, without its prior written approval. The Consultant will act promptly to give the Contractor directions so the Work is not unreasonably delayed.

1.5. DESCRIPTION OF THE WORK

1.5.1. The Work of this Contract includes furnishing labour, materials, equipment, services and other related expenses to complete the Work specified under the Contract Documents.

1.5.2. Term "NIC" means Work of this Project which is not being performed or provided under this Contract; term means "Not In this Contract" or "Not a Part of the Work to be Performed or Provided by Contractor".

1.5.3. "NIC" work may be specified or indicated on the Drawings as an aid to the Contractor in scheduling amount of time and materials necessary for completion of the Contract.

1.6. SCHEDULING

1.6.1. Base sequence and scheduling of construction on maintaining continuous operation and access to the Work during construction.

1.6.2. Phase construction as described in this Section. Notify the Owner in writing 7 Days prior to beginning work in an occupied area. The Owner will accommodate request within 7 Days of the notification. Co-ordination with the Owner at the Place of the Work is crucial. Submit a progress schedule before commencement of the Work. Coordinate any suggested changes to schedule with the Owner. Ensure schedule includes adequate time for Product delivery and Shop Drawing preparation, review and resubmission.

1.6.3. Allow for un-scheduled interruption to schedule of the Work and suspend parts of the Work affected to permit the Owner to relocate furniture and equipment from the Place of the Work, into finished spaces. The Owner will coordinate this interruption.

1.7. COMPLETION DEADLINES

1.7.1. Phase and schedule the Work to meet deadlines originally committed to by the Contractor.

1.8. INCLEMENT WEATHER AND COLD WEATHER WORK

1.8.1. Take precautions during inclement weather and provide adequate protection.

1.8.2. Continue the Work, including winter months, if applicable, until the Work is completed and accepted by the Consultant.

1.8.3. Inclement weather or extra work caused thereby shall not be considered valid reason for additional payment or delay in satisfactory conclusion of the Work.

1.9. OWNER OCCUPANCY

1.9.1. The Owner reserves right to occupy and use portions of premises, whether the Work is partially or entirely completed, or whether completed on schedule or not, provided such occupancy does not interfere with the Contractor's continuing Work.

1.9.2. Partial occupancy or installation of equipment by the Owner does not imply acceptance of the Work in whole, or in part, nor shall it imply acknowledgment that terms of the Contract are fulfilled.

1.10. PLACE OF THE WORK

1.10.1. Confine extent of construction activities to area indicated on the Drawings as the Place of the Work and/or within area defined by property lines. Confine all equipment, materials, debris, offices, storage sheds and storage areas to within the boundaries of the scope of the Work unless additional spaces are approved by the Owner.

1.10.2. The Contractor has complete and exclusive use of the Place of the Work for performance of the Work. Assume responsibility for premises assigned, for performance of the Work.

1.10.3. Should the Contractor require that boundaries of the Place of the Work be temporarily extended, obtain approval of the Consultant.

1.10.4. Certain restrictions are specified as to use by the Contractor of various portions of the Place of the Work. Become familiar with these restrictions and establish work plan to accommodate these restrictions. No claims for extra costs due to such restrictions will be considered by the Owner.

1.10.5. Assume responsibility for care, custody and control of property which is assigned for performance of the Work. Assume responsibility for and Make Good damage to existing property attributable to performance of the Work.

1.11. DEMOLITION, SECURITY AND ACCESS

1.11.1. Coordinate demolition times, security requirements and access with the Owner.

1.12. EXISTING AREAS AND WORK OF OTHER CONTRACTORS

1.12.1. Commencement of parts of the Work in existing areas and in areas provided by Other Contractors, will be deemed to signify the Contractor's acknowledgment and acceptance of those parts of the Work.

1.12.2. Immediately report defects, which affect quality and performance of the Work, in writing to the Consultant.

1.12.3. Existing premises will remain occupied during the Work. Execute the Work to cause minimum interference with activities in existing premises and maintain maximum safety to occupants. Take reasonable measures to minimize and control noise, dirt and dust during the Work.

1.12.4. Before entering existing premises to carry out the Work or to obstruct or take out of use any area of existing premises, or to cause any other interference, request meeting with the Consultant in order to reach agreement as to time and length of time you may interfere, possess, obstruct or remove from use any such area or services.

1.12.5. Maintain temporary entrances to work area) including enclosed hoardings as required. Maintain access to existing service entrance(s) at all times, including ready access for fuel oil trucks and delivery vehicles. Bridge excavations with construction to safely support any load that could be imposed or provide personnel to assist in deliveries to building(s) as required.

1.13. SIGNS, ADVERTISING AND PUBLICATIONS

1.13.1. Do not erect or display devices, signs or advertisements of labour, materials or services provided to the Work. Signs relative to fire, danger and safety are exempted from this requirement.

1.13.2. Do not consent to advertising of the Work, of any kind, without the Owner's and the Consultant's written approval. Do not consent to mention of the Work in any advertising or articles in any publication relating to the Work without approval of copy and written permission from the Owner and the Consultant.

1.14. PROCEDURE AND SUPPLY OF CRITICAL MATERIALS

1.14.1. Supply Products in ample time to be installed into the Work together with templates, measurements and other information required for placement.

1.15. RESTRICTIONS

1.15.1. The Work shall be confined to the Site limits indicated on the Drawings and/or within area defined by property lines. Work on the Municipal property shall be carried out under regulations of respective Municipality and Authorities Having Jurisdiction including without any limitations any associated fees, permits, insurance or bonding required.

1.15.2. Bring following restrictions to attention of workers on the Work and enforce them:

1.15.2.1. Restrict construction personnel to the Place of the Work and necessary access routes to it. Restrict non-construction personnel from the Site, except for the Contractor-authorized visitors.

1.15.2.2. Noisy and disruptive work may require off hours scheduling from 4:30 pm until 8:00 am and shall be coordinated with the Owner.

1.16. SECURITY REGULATIONS

1.16.1. Execute the Work in accordance with following security requirements and regulations.

1.16.2. Ensure only necessary tools and equipment are brought to each work area where access by public is possible. Keep constant check on these items and, at end of each work shift, bring all tools and equipment to storage room as directed.

1.16.3. Construction work is NOT permitted weekdays between 8:00am – 4:30pm. Contractors are only permitted to work Monday to Friday 4:30pm – 8:00am and on weekends.

1.16.4. The Owner will provide security escort for the Work in locations it deems necessary.

1.16.5. The Owner may issue suitable keys to the Contractor, where possible. The Contractor shall sign receipt for keys issued and shall be responsible for admittance of its authorized personnel only to areas for which keys provide access. Return keys to the Owner immediately upon request.

1.16.6. Direct enquiries regarding security regulations to the Owner, who will advise the Contractor of any additional requirements.

1.16.7. Execute the Work taking into consideration movement of occupants.

1.18. EXISTING SITE SERVICES

1.18.1. Before commencing the Work, establish location and extent of existing services in area of the Work and notify the Consultant of findings.

1.18.2. If disruption of services which affects operation of existing building is necessary, give a minimum of 5 Working Days' notice to the Consultant and the Owner. Provide temporary services and obtain prior acceptance from the Consultant and the Owner with regard to timing and methods for providing temporary services.

1.18.3. Submit schedule to and obtain approval from the Consultant for each proposed shut-down of active service or facility. Adhere to approved schedule and provide notice to affected parties. Disconnect and relocate public utilities encountered in connection with the Work with minimum disturbance to occupants, their activities, pedestrian, vehicular traffic, public and private property. Issue notices, arrange for or provide services involving:

1.18.4.1. water pipes.

1.18.4.2. sanitary and storm sewers.

1.18.4.3. telephone conduits and cables.

1.18.4.4. electrical conduits and cables.

1.18.4.5. other similar items.

1.18.4. Should any piping, cables, or similar services be encountered during work of this Contract that are not known from the Owner's and utility companies' records, notify the Consultant and do not proceed with

removal or cutting until directed.

1.19. SITE WORK

1.19.1. Restore existing paving, sidewalks, curbs and landscaping damaged during construction. Provide paving, walks, curbs and landscaping to match existing conditions where not otherwise shown.

1.19.2. Provide sod to replace damaged grass and maintain it until it has rooted properly.

1.20. NO SMOKING POLICY

1.20.1. Cooperate, respect and comply with Smoke Free Workplace policy requirements of the Place of the Work. This policy applies to everyone who visits and works on this Project are instructed to comply with Smoke Free Workplace policy requirements.

1.21. ACOUSTIC PARTITIONS/CEILINGS

1.21.1. Partitions and/or ceilings with sound attenuation insulation are designated as “Acoustic Partitions and Ceilings”. Provide sound rated partitions and ceilings in locations indicated to meet required minimum Sound Transmission Class (STC) ratings. If not stated otherwise, STC rating is 47.

1.21.2. Coordinate work of various Subcontractors to avoid “short circuiting” of the STC rating for “Acoustic Partitions and Ceilings”. Carefully locate and treat ducts, grilles, diffusers, electrical outlets, boxes and other similar mechanical and electrical devices. Where electrical boxes are situated back-to-back serving each side of the partitions, locate them at least 250 mm (10") apart laterally and if interconnected, use flexible connections.

1.2.1.3. Ensure to seal around cutouts for lights, cabinets, pipes, ducts, electrical boxes and other similar items. Avoid back-to-back penetrations of the diaphragm, flanking paths and door/ borrowed light openings. Refer to Section 09 21 16 – Gypsum Board for additional requirements.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including the Articles of Agreement, the General Conditions and Supplementary Conditions.

1.1.2. Comply with Division 1 requirements and documents referred to in this Section.

1.2. REFERENCES

1.2.1. Abbreviations and Acronyms:

1.2.1.1. CCO: Contemplated Change Order.

1.2.1.2. CD: Change Directive.

1.2.1.3. CO: Change Order.

1.2.1.4. HST: Harmonized Sales Tax.

1.3. CASH ALLOWANCES

1.3.1. The purpose of the Cash Allowances, if any, in the Bid Form is to cover the cost of extra work approved by the Region at its sole discretion, if required.

1.3.2 If the Region requests that a Cash Allowance be expended, the Contractor shall consult with the Consultant and/or Region in the selection of the Products, services and/or vendors required to carry out the work under the Cash Allowance, and shall obtain the Region's approval for the selection of Products, services and/or vendor(s) in relation to the Cash Allowance.

1.3..3 If required by the Region, the Contractor shall obtain bids from a minimum of three vendors in relation to a Cash Allowance item, and submit the bids received to the Region and/or Consultant for approval.

1.3.4 The Contractor shall submit, with the application for payment, an invoice showing the date of purchase, the vendor from which the purchase was made, the date of delivery of the Product or service, and the price, including delivery to the Site and all applicable taxes.

1.3.5 Cash Allowance payments will only be made with the written authorization of the Region, and shall not include any markups whatsoever. The Contractor shall have no claim on any unused portion of any Cash Allowance item.

1.3.6. Extend to the Owner refunds, trade and quantity discounts which may be received in purchasing under Cash Allowances, except cash discounts for prompt payment.

1.3.7. In submitting final adjustments of Cash Allowances, include duplicate, summary statements and copies of receipted invoices substantiating purchases under Cash Allowances.

1.3.8. Cash Allowance No. 1:Inspection and Testing,

1.3.5.1. Include the sum of: $20,000

1.3.9. Cash Allowance No. 2: Altos Partition Modifications,

1.3.6.1. Include the sum of: $30,000

1.3.10. Cash Allowance No. 3: Supply and Installation of finish door hardware

1.3.8.1. Include the sum of: $50,000.00

1.3.11. Cash Allowance No.4: Fire Stropping, not identified on the Architectural and Mechanical Drawings (discovered during demolition):

1.3.9.1 $30,000.00

1.4 NOT USED

1.5. CASH FLOW SCHEDULE

1.5.1. Prior to commencement of the Work, submit a detailed cash flow projection schedule indicating anticipated billings on a month-by-month basis for duration of the Work, including timing of holdback release.

1.5.2. Update cash flow schedule monthly, recording cumulative as well as monthly totals.

1.6. PROGRESS BILLING BREAKDOWN

1.6.1. Prior to commencement of the Work, submit a detailed progress billing breakdown and obtain approval of the Consultant.

1.6.2. Progress billing breakdown shall include itemized values, (each excluding HST), applied against each of following:

1.6.2.1. mobilization and start-up.

1.6.2.2. general site expenses.

1.6.2.3. Cash Allowance amount.

1.6.2.4. each Section of Specifications (Divisions 2 - 49 inclusive).

1.6.2.5. as-built Drawings broken down by Architectural, Structural, Mechanical and Electrical disciplines.

1.6.2.6. Project closeout, comprising separate sums for:

1.6.2.6.1. manuals.

1.6.2.6.2. maintenance materials.

1.6.2.6.3. commissioning and training/demonstration for Owner's staff.

1.7. CHANGES IN THE WORK DUE TO A SUPPLEMENTAL INSTRUCTION

1.7.1. Supplemental Instruction does not normally include any change in the Contract Price nor in the Contract Time. The Contractor shall formally notify the Consultant in writing within 10 Days that Supplemental Instruction requires an amendment in the Contract Price and/or the Contract Time. If satisfied, the Consultant will issue a CCO for processing, or if notification has not been received within 10 Days, it is understood that there are no anticipated changes in the Contract Price and the Contract Time.

1.8. CONTRACT MODIFICATION PROCEDURES

1.8.1. Conform to GC 14 - Changes in the Work in the General Conditions of the Contract.

1.8.2. Further to GC 14 – Changes in the Work, promptly and not later than 10 Working Days after becoming aware of circumstances which may require a change in the Work or other directions, give written notice to the Consultant outlining such circumstances and requesting proposed change. Do no work in affected area, or that would prevent the Consultant from properly evaluating circumstances and proposed change, without obtaining written approval. The Consultant will act promptly to give the Contractor directions so Work is not unreasonably delayed.

1.8.3. Advise the Consultant in writing of any contradictions, discrepancies, omissions or errors discovered or revealed. Do not proceed before obtaining clarifications and directions from the Consultant in writing. Failure to follow this shall result in the Contractor assuming full responsibility for resulting circumstances and costs.

1.9. CHANGE ORDER AND CHANGE DIRECTIVE

1.9.1. Conform to GC 15 – Change Order and GC 16 – Change Directive in the General Conditions of the Contract.

1.9.2. Any variation in the Contract involving a change in total amount of the Contract Price or in Contract Schedule shall be initiated through the Consultant in form of a CCO describing work proposed under variation and requesting a quotation from Contractor.

1.9.3. Three copies of CCOs or CDs will be issued to Contractor. Additional copies of these documents, including referenced Drawings and Schedules, shall be provided by the Contractor.

1.9.4. Immediately inform all relevant Subcontractors and Suppliers of the proposed change.

1.9.5. Upon receipt of a CCO by the Contractor and where specifically directed by the Consultant, suspend all work affected by the proposed change until a CO is issued, or until CCO is cancelled.

1.9.6. Upon receipt of a CD, begin the work described therein as soon as possible and prepare a quotation for the work.

1.9.7. Return 1 copy of the CCO or CD with a quotation for the work.

1.9.8. Include all work described in the CCO and all other work caused, however incidental it may be, by the proposed change. Once the CO is issued by the Owner, no further claims for extra costs or time extensions will be accepted.

1.9.9. If quotation received is unacceptable, the Consultant will reject quotation and request revised quotation from the Contractor.

1.9.10. When the Consultant deems quotation acceptable, it will prepare a CO.

1.9.11. Value of changes in work shall be determined and processed in accordance with the General Conditions .

1.10. APPLICATION FOR PROGRESS PAYMENTS AND PROGRESS PAYMENTS

1.10.1. Conform to GC 18 – Certificates and Payments and GC 19 – Taxes and Duties in the General Conditions of the Contract.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this Section.

1.2. REFERENCES

1.2.1. Abbreviations and Acronyms:

1.2.1.1. MSDS: Material Safety Data Sheets.

1.2.1.2. OHSA: Occupational Health and Safety Act.

1.2.1.3. WHMIS: Workplace Hazardous Materials Information System.

1.3. PROJECT COORDINATION

1.31. Study the Contract Documents to determine extent of Work required by each Specification section and upon which Work of other sections depend and coordinate scope and extent of Work to be performed by each trade. Neither organization of the Specifications into Divisions and 3-part section format nor arrangements of the Drawings, schedules and Drawings shall affect in any way the Contractor's control in, or diminish its responsibility for, dividing the Work or establishing each Subcontractor's scope of Work. Claims for additional compensation arising from disputes between Subcontractors due to lack of coordination by the Contractor will not be considered.

1.3.2. Coordinate Work of each section as required for satisfactory and expeditious completion of the Work. Take field dimensions required. Take into account existing installations to assure best arrangements of components in available space. Consult before commencing the Work in critical locations. Fabricate and erect the Work to suit field dimensions and field conditions.

1.3.3. Provide forms, templates, anchors, sleeves, inserts and accessories or other components required to be fixed to or inserted in the Work. As applicable, set them in place or instruct related Specification sections as to their location.

1.3.4. Pay cost of extra Work if necessary to maintain the agreed upon schedule.

1.3.5. Coordinate Work of all Subcontractors including construction sequence, schedule and interfacing of all Work. Coordinate Work as required to incorporate metric modular components. Coordinate Work of each Subcontractor as required for satisfactory and expeditious completion of the Work. Ensure components to be built in are supplied in time with setting Drawings and other related information. Fabricate and erect the Work to suit field dimensions and field conditions.

1.3.6. Ensure the Contract Documents are fully coordinated with respect to architectural, structural, mechanical, electrical and other specialty requirements.

1.3.7. Cooperate and coordinate with the Consultant for moving the Owner's equipment into building when the Work or substantial part thereof is ready for use for purpose intended.

1.4. DOCUMENTS ON SITE

1.4.1. Maintain in good condition and order on site 1 copy of Addenda, proposed changes in the Work, Change Orders, test reports, manufacturer's installation and application instructions, progress photographs, as- built Drawings, approved progress schedules, minutes of site meetings, and other modifications to the Contract Documents.

1.5. OWNER, CONSULTANT AND CONTRACTOR (OCC) MEETINGS

1.5.1. Purpose: To review policy, financial status and schedule.

1.5.2. Period: Every 2 weeks on a mutually acceptable schedule.

1.5.3. Attendees:

1.5.3.1. Owner.

1.5.3.2. Consultant(s).

1.5.3.3. Contractor.

1.5.4. Chair: Consultant.

1.5.5. The Consultant shall prepare minutes recording decisions, comments, instructions required and a report on Schedule. The Consultant will distribute minutes to each participant within 5 Working Days.

1.6. SITE COORDINATION AND PROGRESS MEETINGS

1.6.1. Refer also to GC 3.1 of General Conditions of the Contract.

1.6.2. Conduct site meetings at regular intervals (every 2 weeks), to identify and resolve construction coordination items, record minutes including significant proceedings and decisions and identify "action by" parties; and reproduce and distribute to meeting participants, copies of minutes within 3 Working Days after each meeting. The Consultant also reserves right to call additional special emergency site meetings on short notice without any cost to the Owner.

1.6.3. Attendees:

1.6.3.1. The Contractor's project manager and site superintendent.

1.6.3.2. Mechanical and electrical Subcontractors.

1.6.3.3. Subcontractors invited by Contractor.

1.6.3.4. The Owner and/or the Consultant(s).

1.6.4. Chair: Contractor.

1.6.5. Include following:

1.6.5.1. Prepare agenda for meetings.

1.6.5.2. Distribute written notice of each meeting minimum 7 Days in advance of meeting date, stating time and place, to persons whose presence is required.

1.6.5.3. Make physical arrangements for meetings.

1.6.5.4. Record minutes and attendees; include significant proceedings and decisions.

1.6.5.5. Reproduce and distribute copies of minutes after each meeting to parties attending meeting, to parties affected by decisions made at meeting and to the Consultant.

1.6.5.6. Ensure representatives of the Contractor, the Contractor's consultants, Subcontractors and Suppliers attending meetings are qualified and authorized to act on behalf of entity each represents.

1.6.5.7. Ensure relative information is available to allow meetings to be conducted efficiently.

1.6.5.8. Consultant may attend meetings to ascertain whether the Work is consistent with the Contract Documents.

1.6.5.9. Construction Progress Schedule may be reviewed to ensure rapid and efficient completion of Work in accordance with the requirements of the Contract Documents. Keep Consultant informed of progress, of delays and of potential delays during all stages of Work.

1.6.5.10. Review, approval or correction of minutes of previous meeting.

1.6.5.11. Review of Work progress since previous meeting.

1.6.5.12. Field observations, problems, conflicts.

1.6.5.13 Problems which impede Construction Progress Schedule.

1.6.5.14. Review of off-Site fabrication, delivery schedules.

1.6.5.15. Review of submittals schedules.

1.6.5.16. Corrective measures and procedures to regain projected schedules.

1.6.5.17.. Quality standards.

1.6.5.18. Pending changes and substitutions.

1.6.5.19. Other business.

1.7. START-UP MEETING

1.7.1. Presided over by the Consultant, after award of the Contract.

1.7.2. Attendees:

1.7.2.1. Consultant(s).

1.7.2.2. Contractor.

1.7.2.3. Contractor's superintendent.

1.7.2.4. Subcontractors (mechanical, electrical).

1.7.2.5. Major equipment Suppliers.

1.7.2.6. Others as appropriate.

1.7.3. Minimum Agenda:

1.7.3.1. List of major Subcontractors and Suppliers.

1.7.3.2. Tentative construction progress schedules.

1.7.3.3. Start date; submission of schedules; long term delivery items.

1.7.3.4. Insurance Certificates, Cash Flow Schedule, Construction Schedule, Shop Drawing submission schedule, bonds including Value Added Taxes, Trade Breakdown including value for Close Out, Workplace and Safety & Insurance Board Clearance Certificate, Project Sign.

1.7.3.5. Critical work sequencing.

1.7.3.6. Major equipment and Product deliveries and priorities.

1.7.3.7. Designation of responsible personnel.

1.7.3.8. Building Permit status.

1.7.3.9. Procedures for maintaining record documents.

1.7.3.10. Use of Premises: Office, keys, work and storage areas; Owner's requirements (storage delivery, path of construction activities, vehicle, by foot, carts, exterior and interior, elevator use, washrooms, bin location).

1.7.3.11. Construction facilities, controls, temporary hoarding, dust partitions, parking, hours, noisy work, interruption of services, smoking, cell phone usage and construction aids.

1.7.3.12. Construction scheduling (particularly drying time for concrete slabs).

1.7.3.13. Temporary utilities.

1.7.3.14. Safety and first-aid procedures.

1.7.3.15. Security procedures.

1.7.3.16. Housekeeping procedures.

1.8. PRE-INSTALLATION TRADE MEETINGS

1.8.1. If a Subcontractor requires a meeting prior to starting Work, arrange for such meeting of all parties associated with the Subcontractor trade as designated in the Contract Documents or as requested by the Consultant. Presided over by the Contractor, include the Consultant who may attend, include Subcontractor performing the Work involved, testing company's representative and the Contractor's consultants of applicable discipline. Review the Contract Documents for the Work for which the Subcontractor is responsible and determine complete understanding of requirements and responsibilities relative to the Work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, project staffing, restrictions on areas of concrete placement and other matters affecting construction, to permit compliance with intent of trade under consideration.

1.9. SCHEDULE OF THE WORK

1.9.1. Submit a detailed bar chart [critical path] construction schedule with activities itemized to enable the Contractor and the Consultant to monitor progress of the Work.

1.9.2. Schedule shall indicate without limitations dates for:

1.9.2.1. erection and dismantling of temporary facilities.

1.9.2.2. submission of Shop Drawings for various divisions of the Work.

1.9.2.3. submission of mechanical and electrical trades coordination and interference Drawings.

1.9.2.4. submission of samples and sample installations.

1.9.2.5. commencement and completion of each major division of the Work, including Work to be done by Subcontractors.

1.9.2.6. critical Work sequencing.

1.9.2.7. drying time for concrete slabs to allow for placement of moisture sensitive floor coverings.

1.9.2.8. major equipment deliveries and priorities.

1.9.2.9. final completion date.

1.9.3. Update and resubmit schedule on a monthly basis.

1.10. SHORT TERM SCHEDULE

1.10.1. On a bi-weekly basis, provide the Owner with a 2 week short term schedule based on above schedule, indicating important construction activities as the Owner and Consultant may see suitable for the Contract requirements.

1.11. PROGRESS PHOTOGRAPHS

1.11.1. Submit progress photographs in digital and hard copy formats, taken by a professional photographer, from date of commencement of the Work until the date of Substantial Performance of the Contract.

1.11.2. Submit colour, glossy, 200 mm x 250 mm (8" x 10") photographs in a clear sheet protector suitable for storage in a binder with a white patch in bottom, right corner indicating name of the Contract, compass direction of exposure, subject title, date and time of exposure.

1.11.3. Prior to commencement of the Work, submit 10 photographs of the Place of the Work and 6 photographs along the lines forming the perimeter of the Place of the Work.

1.11.4. During Work, submit 12 photographs reproduced in duplicate, each month, taken from different vantage points to illustrate progress of the Work, both exterior and interior.

1.11.5. Submit 36 interior photographs when the Work has been certified by the Consultant as substantially performed.

1.12. PERSONNEL APPOINTMENT

1.12.1. Appoint a senior member of staff, with full authority to commit the Contractor to methods and schedules for construction, to participate actively in administration and maintenance of detailed construction schedule. Provide necessary information on progress of the Work to enable a status report to be produced every 2 weeks.

1.13. GENERAL REVIEW

1.13.1. The Consultant shall conduct periodic field review to review the Work for general conformance with Contract Documents, code and Authorities Having Jurisdiction.

1.13.2. Review includes review of Shop Drawings, review of field work and review of reports produced by various inspection and testing agencies.

1.13.3. Record each review in manner suitable for submission to the Consultant at completion of the Contract along with inspection and testing reports at site meetings every second week.

1.14. PRODUCT SUBSTITUTION PROPOSALS

1.14.1. After award of the Contract, Product substitution proposals will not be reviewed or accepted except in cases where written proof from Product manufacturer/distributor has been submitted to verify specified Products:

1.14.1.1. are unavailable (providing reasons why).

1.14.1.2. were ordered in advance and in accordance with manufacturer's recommendations for lead time but timely delivery of specified Products is not possible in order to maintain construction schedule.

1.14.2. Submit following for each Product substitution proposal:

1.14.2.1. Shop Drawings, including full details.

1.14.2.2. samples.

1.14.2.3. difference in price, if any, in form of certified quotations of both selected and proposed substitutions.

1.14.3. Submit the Contractor's written acceptance of use of substituted Products and certification substituted Products:

1.14.3.1. will not exceed space requirements allocated for originally specified Products or, if they do, the Contractor is including with substitution submission, design drawings, to accommodate substituted Product.

1.14.3.2. are compatible with and inert to adjacent materials.

1.14.3.3. will not affect project schedule due to delays in delivery and installation.

1.14.3.4. have been priced to include design adjustments required to accommodate substituted Products, indicate the Owner's acceptance in writing via a Change Order.

1.14.4. Proposed substitutions require the Consultant's review and acceptance in writing and, if there is a difference in price, extra or credit requires the Owner's acceptance.

1.15. CERTIFICATES AND TRANSCRIPTS

1.15.1. Immediately after receiving notification of award of the Contract, submit Workplace Safety & Insurance Certificate status, transcription of insurances and other certificates and transcripts required by the Contract Documents or the Consultant.

1.16. CONTRACTOR'S PERSONNEL AND SUBCONTRACTORS

1.16.1. Submit complete list of the Contractor's Subcontractors with addresses, phone numbers and personnel along with the Contractor's list of personnel.

1.17. SUBMITTAL PROCEDURES

1.17.1. Submit to the Consultant, and to Authorities Having Jurisdiction as required, documents to be submitted for review. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of the Contract Time or extra costs and no claim for extension of the Contract Time or increase to the Contract Price by reason of such default will be allowed. Final approval of Authorities Having Jurisdiction, where required, shall be obtained prior to submitting Shop Drawing or other documentation to the Consultant.

1.17.2. Prior to submission to the Consultant, the Contractor shall review submittals. Submittals not stamped, signed, dated and identified as to specific Contract will be returned without being examined and shall be considered rejected. Verify field measurements and ensure affected adjacent work are coordinated. Confirm and correlate information pertaining to fabrication processes, quantities, techniques of construction and installation and similar information.

1.18. SHOP DRAWINGS

1.18.1. Shop Drawing Schedule: Submit a Shop Drawing schedule.

1.18.2. Fabrication: Do not fabricate until Shop Drawings are indicated as "REVIEWED" or "REVIEWED AS NOTED" by the Consultant.

1.18.3. The Consultant's Shop Drawing Review:

1.18.3.1. The Consultant's review of Shop Drawings is for sole purpose of ascertaining conformance with general design concept.

1.18.3.2. The Consultant's review does not provide approval of items which remain the Contractor's responsibility.

1.18.3.3. Without limitation, among other things, the Contractor remains responsible for:

1.18.3.3.1. detail design inherent in Shop Drawings.

1.18.3.3.2. errors and omissions in Shop Drawings.

1.18.3.3.3. meeting requirements of the Contract Documents.

1.18.3.3.4. confirmed and correlated Site dimensions.

1.18.3.3.5. information that pertains solely to fabrication processes, techniques of construction and installation.

1.18.3.3.6. co-ordination of work of all Subcontractors.

1.18.4. Shop Drawing Requirements:

1.18.4.1. Indicate following minimum requirements as applicable:

1.18.4.1.1. plans, sections and details.

1.18.4.1.2. verified Site dimensions.

1.18.4.1.3. materials thicknesses and finishes.

1.18.4.1.4. methods of setting and sealing.

1.18.4.1.5. methods of securing, fastening and anchoring including field connections.

1.18.4.1.6. signed and sealed Shop Drawings and calculations where specifically required herein.

1.18.4.2. Do not make Product substitutions on Shop Drawings without the Consultant's written acceptance in accordance with Product substitution proposal process or they will be rejected. Replace unaccepted Product substitutions and complete the Work in accordance with the Contract Documents.

1.18.4.3. Determine which Shop Drawings the local Building Department will require for its approval and submit 2 final copies of each Shop Drawing to local Building Department. Obtain approval and pay associated charges and fees.

1.18.5. Shop Drawing Procedures:

1.18.5.1. The Consultant will provide a Shop Drawing stamp to the Contractor for use on the Work. Shop Drawing stamp remains the Consultant's property and must be returned at conclusion of the Work.

1.18.5.2. Execute following prior to submitting Shop Drawings to the Consultant:

1.18.5.2.1. review, check and mark-up Shop Drawings with comments and revisions and re-direct back to Subcontractor (“REVISE AND RESUBMIT”, etc.) in the first instance if required prior to forwarding to the Consultant.

1.18.5.2.2. stamp each Shop Drawing with Consultant's Shop Drawing stamp.

1.18.5.2.3. insert applicable Specification section reference, e.g. "10 28 00" for Section 10 28 00, Washroom Accessories.

1.18.5.2.4. insert next consecutive Shop Drawing number within that section, e.g. "002" for second Drawing within Section 10 28 00.

1.18.5.2.5. insert the Contractor's review date and signature of the Contractor's reviewer.

1.18.5.3. Submit following for the Consultant's review:

1.18.5.3.1. 1 print of each stamped Shop Drawing, to be returned to the Contractor.

1.18.5.3.2. 3 prints of each stamped Shop Drawing, not returned to the Contractor.

1.18.5.3.3. If catalogue cuts acceptable to the Consultant, submit as many copies of catalogue cuts for review as agreed to. Only 1 set to be returned to the Contractor.

1.18.5.4. Reproductions of the Consultant's Contract Documents are not acceptable as Shop Drawings.

1.18.5.5. Shop Drawings not conforming to above criteria will be automatically returned without review. Any resulting delays will be the Contractor's responsibility.

1.18.5.6. Shop Drawings submitted without specified Professional Engineer design and stamp will be automatically returned without review. Any resulting delays will be the Contractor's responsibility.

1.18.5.7. Do not resubmit Shop Drawings indicated as "REVIEWED" and "REVIEWED AS NOTED".

1.18.5.8. Resubmit Shop Drawings indicated as "REVISE AND RESUBMIT" with required changes and comments addressed. Insert letter "R" after Shop Drawing number on resubmitted Shop Drawings, re-date and re-sign. Identify revisions from earlier submissions graphically on revised Shop Drawings.

1.18.5.9. The Consultant requires 14 Days for review of Shop Drawing from time of the Consultant's receipt to time of the Consultant's return to the Contractor. The Contractor will establish a steady flow of Shop Drawings for review and avoid accumulation of an excessive quantity of Shop Drawings in a single submission.

1.18.5.10. Provide Shop Drawings required by the Contract Documents.

1.19. INTERFERENCE DRAWINGS

1.19.1. Prepare Drawings indicating relationship of new and existing and/or unforeseen conditions at congested areas prior to commencement of work in area.

1.19.2. For congested locations, before commencing installation, prepare Drawings showing relationship of ductwork, conduit, piping, sprinklers, ceiling supports and framing, communication and specialized equipment located within ceiling and shaft spaces.

1.19.3. Indicate locations of visible items such as air handling outlets, light fixtures, smoke detectors, sprinkler heads, communication grilles and access panels occurring at these locations.

1.19.4. Ensure interference Drawings are initialed by a responsible person of each Subcontractor involved along with the Contractor's signature and submitted to the Consultant for review and record purposes.

1.20. SAMPLES

1.20.1. Prior to fabrication or supply of Products, submit samples for the Consultant's review. Remove and discard Products whose samples have not been reviewed and accepted by the Consultant.

1.20.2. Deliver samples to the Consultant as directed with charges prepaid and allow for 1 of the samples to be kept by the Consultant.

1.20.3. Unless otherwise specified, submit samples in duplicate.

1.20.4. Identify each sample with:

1.20.4.1. Contract name and Contract number.

1.20.4.2. date of sample submission.

1.20.4.3. component name using the Specification's terminology.

1.20.4.4. material (including alloy).

1.20.4.5. finish including colour, sheen, texture.

1.20.4.6. dimensions including thickness.

1.20.5. Exhibit each of the following for each sample:

1.20.5.1. materials.

1.20.5.2. finishes:

1.20.5.2.1. material.

1.20.5.2.2. colour including maximum colour range within each specified colour.

1.20.5.2.3. sheen, tone.

1.20.5.2.4. texture.

1.20.5.2.5. range of blemishes and other markings.

1.20.6. Alter, refinish or provide additional samples until they are reviewed and accepted by the Consultant.

1.20.7. Fabricate samples using same tools and techniques to be employed in actual installation of the Work.

1.20.8. Provide Products in the Work which are identical to accepted samples.

1.20.9. Provide samples required by the Contract Documents.

1.21. ACCESS PANELS AND ACCESS DOORS

1.21.1. Before commencing installation of mechanical and electrical work, prepare, together with mechanical and electrical Subcontractors, on a set of the Drawings provided for that purpose, a complete lay-out of all access panels and access doors which will be required. Submit these lay-outs for review by the Consultant as specified for Shop Drawings and show exact sizes and locations of access panels and doors. Revisions may be required to lay-out before final review by the Consultant. Allow the Consultant to revise layout or quantity of access doors and panels by relocating related building services a maximum of 2000 mm (6' - 7") at no extra cost to the Owner. Should relocation exceed this measurement then the Contract Price may be adjusted in accordance with provisions for changes in the Contract Documents.

1.21.2. Finish access panels and doors to match adjacent wall and/or ceiling finish unless otherwise specified or indicated.

1.22. WHMIS REQUIREMENTS

1.22.1. Comply with WHMIS in accordance with OHSA requirements.

1.22.2. Before commencement of the Work and during full term of the Contract, provide a list with current MSDS of all hazardous materials proposed for use on the Contract.

1.22.3. In addition to submission of MSDS as required under regulations, submit emission reports where available or off-gassing data to help control possible harmful effects to indoor air quality during

construction, occupation and including maintenance period.

1.22.4. Label hazardous materials used and/or supplied on the Contract in accordance with WHMIS requirements.

1.22.5. Provide detailed procedures for safe handling storage and use of hazardous materials. List special precautions and safe clean up and disposal procedures. Conform to the Environmental Protection Act and other requirements of Authorities for disposal and clean up requirements.

1.22.6. Obtain from the Owner, where applicable, a list and MSDS of hazardous materials that may be handled, stored or used by the Owner's employees and/or Other Contractors retained by the Owner at location where the Work of this Contract will be performed.

1.22.7. Ensure those who handle and/or are exposed to or are likely to handle or be exposed to hazardous materials are fully instructed and trained in accordance with WHMIS requirements.

1.23. COLOURS

1.23.1. Colour and gloss value to be selected by the Consultant. Obtain direction on colour and gloss value in advance of need. If requested, submit samples for colour and gloss selection. Follow colour schedule provided by the Consultant and use colours and gloss designated.

1.24. RECORD DRAWINGS AND SPECIFICATIONS

1.24.1. Keep 1 set of Drawing prints and Specifications on Site for use in maintaining record information. Ensure these Drawings and Specifications are kept on Site at all times available for review by the Owner and/or the Consultant at any given time.

1.24.2. Accurately and neatly record deviations from the Contract Documents, including Addenda, Site Instructions and Change Orders, caused by Site conditions.

1.24.3. Record information concurrently with construction progress. Do not conceal actual work until required information is recorded.

1.24.4. Legibly indicate each item to record actual construction including:

1.24.4.1. Field changes of dimension and details.

1.24.4.2. Details or information not on original Contract Drawings.

1.24.5. Catalogue field review reports and cross reference to relevant trade, building area and component. Submit inspection and testing reports in accordance with requirements of the Specifications. Highlight unsatisfactory inspection and testing results with supplementary instructions issued by the Consultant.

1.24.6. Identify Drawings as "Project Record Copy", maintained and available for inspection on the Site by the Consultant.

1.24.7. Prior to applying for Certificate of Substantial Performance submit record Drawings and Specifications to the Consultant.

1.25. AS-BUILT DRAWINGS

1.25.1. Prior to applying for Certification of Substantial Performance, the Consultant will provide the Contractor with electronic set of requested Drawings for as-built purposes.

1.25.2. The Contractor is responsible for:

1.25.2.1. maintaining as-built Drawings during progress of work, in complete sets, at the Place of the Work.

1.25.2.2. including additional changes over and above those included in any Addenda, Site Instructions and Change Orders.

1.25.2.3. including accurate locations, depths, sizes and types of underground utilities and concealed services in the as-built Drawings.

1.25.2.4. having changes recorded in a manner consistent with the original Drawings using minimum AutoCad software.

1.25.2.5. ensuring outline clouds and notations are removed from the Drawings.

1.25.2.6. having 1 set as-built Drawing prints submitted to the Consultant for review before final submission.

1.25.2.7. incorporating any review comments made by the Consultant.

1.25.2.8. resubmitting final reviewed set in following format:

1.25.2.8.1. 1 set on electronic disk.

1.25.2.8.2. 1 set on reproducible prints (i.e. mylar).

1.25.2.8.3. 1 set of white prints.

1.25.3. Refer to Divisions 21, 22, 23, 26, 27 and 28 for supplementary requirements.

1.26. OPERATION AND MAINTENANCE INSTRUCTIONS MANUAL

1.26.1. Upon completion of the Work, submit 3 sets of operation and maintenance instructions manual to the Consultant. Include following:

1.26.1.1. data books and literature.

1.26.1.2. maintenance instructions, specifying warnings of any maintenance practice that may damage or disfigure specified Products.

1.26.1.3. operational information on Products, cleaning and lubrication schedules, filters, overhaul and adjustment schedules and similar maintenance information.

1.26.1.4. recommended maintenance Products.

1.26.2. Submit instructions in plain language to guide the Owner in proper operation and maintenance of building components.

1.26.3. Organize contents into applicable categories of the Work, numbered to match the Specification section numbering system.

1.26.4. Bind contents of operation and maintenance instructions manual in 3-ring, hard-covered, vinyl jacketed binders, label spine "OPERATION AND MAINTENANCE INSTRUCTIONS MANUAL" and include following:

1.26.4.1. title sheet, labelled "OPERATION AND MAINTENANCE INSTRUCTIONS", containing project name and completion date.

1.26.4.2. list of contents.

1.26.4.3. list of names, addresses and telephone numbers of installing Subcontractors and Suppliers for future repair or maintenance.

1.26.4.4. schedule of Finishes (as-built) listing paints, colours and fabrics provided.

1.26.5. Refer to Divisions 21, 22, 23, 26, 27 and 28 for supplementary requirements.

1.26.6. Provide operation and maintenance instructions as required by the Contract Documents.

1.27. MISCELLANEOUS SUBMITTALS

1.27.1. Supply submittals required by the Contract Documents (e.g. plans, reports, certifications, results, records, etc.) for the Consultant's review.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this section.

1.2. REFERENCES

1.2.1. Reference Standards:

1.2.1.1.	ASTM E329	-Specification for Agencies Engaged in Construction Inspection and/or Testing
1.2.1.2.	CSA A283-06	- Qualification Code for Concrete Testing Laboratories
1.2.1.3.	CSA W47.1-03	- Certification of Companies for Fusion Welding of Steel
1.2.1.4.	CSA W59-03	- Welded Steel Construction (Metal Arc Welding)
1.2.1.5.	CSA W178.1-08	- Certification of Welding Inspection Organizations
1.2.1.6.	CSA W178.2-08	- Certification of Welding Inspectors
1.2.1.7.	CAN/CSA-Z234.1-00	- Metric Practice Guide
1.2.1.8.	NFPA 101-09	- Life Safety Code

1.3. REGULATIONS REQUIREMENTS

1.3.1. Comply with the *Building Code Act, 1992*, S.O. 1992, c. 23 as amended, and the Building Code, O. Reg. 332/12, as amended and Regulations and bylaws of other Authorities Having Jurisdiction, including latest amendments thereto; all hereafter referred to as the Code. Where the Code or the Contract Documents do not cover particular requirements which are covered by NBC, as amended, conform to requirements of NBC including its related supplements. Where the Contract Documents exceed the Code requirements, satisfy such additional requirements.

1.3.2. Pre-Start Health and Safety Review (PSR): Whether or not this is required by law, under this Contract ensure any Product, tool or process provided as Work of this Contract complies with the requirements of the *Occupational Health and Safety Act,* R.S.O. 1990, c. O.1, Regulation 851: Industrial Establishments, R.R.O. 1990, Reg. 851 , as amended and certify same to Consultant prior to Substantial Performance of the Contract. For guidance, refer to “Guidelines for Pre- Start Health and Safety Reviews: How to Apply Section 7 of the Regulation for Industrial Establishments” dated April 2001 published by the Government of Ontario. Ensure all exemption documents or PSR reports are complete and correct prior to handing over to the Owner. Provide [3] sets of originals to the Owner.

1.3.3. Conform to NFPA 101 for exit requirements.

1.3.4. Conform to the Fire Code, O. Reg. 213/07: enacted under *Fire Protection and Prevention Act, 1997*, S.O. 1997, c. 4, , as amended.

1.3.5. Where material is designated in the Contract Documents for certain application, unless otherwise specified, that material shall conform to standards designated in OBC and in absence of more restrictive requirement comply with Division B, Part 9 "Housing and Small Buildings" of the Code. Similarly, unless otherwise specified and not required otherwise by OBC, installation methods and standards of workmanship shall also conform to standards of Division B, Part 9. Where specific requirements for a material are not specified for certain use, select from choice offered in Division B, Part 9.

1.3.6. Unless otherwise indicated in the Contract Documents, obtain and pay for all other permits, licenses and certificates of inspection. Ensure permits, licenses and certificates included under specific sections are obtained as specified. Forward copies of all permits to the Consultant before commencing work.

1.3.7. Comply with all requirements of the *Workplace Safety and Insurance Act, 1997*, S.O. 1997, c. 16, Sched. A, including payments due thereunder.

1.3.8. Apply the *Ontario College of Trades and Apprenticeship Act, 2009*, S.O. 2009, c. 22 , and regulations thereunder, as amended, to performance of this Contract.

1.4. IMPERIAL/INTERNATIONAL SYSTEM OF UNITS (SI)

1.4.1. Submittals containing measurements of any kind in Imperial system of measurement shall be on the Consultant's approval only. Submit all measurements in International System of Units (SI).

1.4.2. Submittals containing measurements of any kind shall have measurements in language of International System of Units (SI) conforming to CAN/CSA-Z234.1.

1.5. REFERENCES

1.5.1. Where reference is made to codes, specification standards, manuals, contract forms, installation, application and maintenance instructions, produced by various organizations, conform to edition of standards specified or, if not specified, to latest edition as amended and revised to date of the Contract.

1.5.2. Amendments to reference documents after award of the Contract affecting the Contract Price shall be dealt with in accordance with GC 14, Changes in the Work of the General Conditions of the Contract.

1.5.3. If requested by the Consultant provide copy on Site of such standard(s).

1.6. ACRONYMS

1.6.1. Following acronyms are used in the Contract Documents:

AA	Aluminum Association (USA)
ACI	American Concrete Institute
AHA	American Hospital Association
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
API	American Petroleum Institute
ASHE	American Society for Healthcare Engineering
ASHRAE	American Society of Heating, Refrigeration and Air-conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWI	American Woodwork Institute (USA)
AWMAC	Architectural Woodwork Manufacturer's Association of Canada
AWWA	American Water Works Association
BCA	Building Commissioning Association
BCLMA	British Columbia Lumber Manufacturer's Association
BHMA	Building Hardware Manufacturer's Association
BMEC	Building Materials Evaluation Commission

CAN	National Standards of Canada
CCA	Canadian Construction Association
CCDC	Canadian Construction Documents Committee
CEC	Canadian Electrical Code (published by CSA)
CFR	Code of Federal Regulations
CGA	Canadian Gas Association
CGSB	Canadian General Standards Board
CISC	Canadian Institute of Steel Construction
CLA	Canadian Lumbermen's Association
CMHC	Canadian Mortgage and Housing Corporation
COFI	Council of Forest Industries of British Columbia
CPCI	Canadian Prestressed Concrete Institute
CPMA	Canadian Paint Manufacturer's Association
CRCA	Canadian Roofing Contractors Association
CRI	Colour Rendering Index
CSA	Canadian Standards Association
CSC	Construction Specifications Canada
CSDMA	Canadian Sheet Door Manufacturers Association
CSPI	Corrugated Steel Pipe Institute
CSSBI	Canadian Sheet Steel Building Institute
CTC	Canadian Transport Commission
CWC	Canadian Wood Council
DND	Department of National Defence, Construction Material Board
EEMAC	Electrical and Electronic Manufacturers Association of Canada
ECP	Environmental Choice Program
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
ESA	Electrical Safety Authority
FM	Factory Mutual
FSC	Forest Stewardship Council
GANA	Glass Association of North America
ICEA	International Electrical Testing Association
IEC	International Electrotechnical Commission
IAQ	Indoor Air Quality
IEEE	Institute of Electrical and Electronic Engineers
IGMAC	Insulated Glass Manufacturers Association of Canada
ISO	International Organization for standardization
MTO	Ministry of Transportation, Province of Ontario
NAAMM	National Association of Architectural Metal Manufacturers
NBC	National Building Code of Canada 2015
NBFU	National Board of Fire Underwriters (USA)
NEMA	National Electrical Manufacturers Association (USA)
NETA	Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
NFPA	National Fire Protection Association
NHLA	National Hardwood Lumber Association (USA)
NLGA	National Lumber Grades Authority
NRCC	National Research Council Canada
NSC	National Standards of Canada

OBC	Ontario Building Code, "The Building Code", O. Reg. 332/12 including amendments thereto
OFC	Ontario Fire Code, "The Fire Code", O. Reg. 213/07, including amendments thereto
OFM	Ontario Fire Marshall
OIRCA	Ontario Industrial Roofing Contractors Association
OMCA	Ontario Masonry Contractors' Association
OPCA	Ontario Painting Contractors Association
OPSS	Ontario Provincial Standards Section
PEO	Professional Engineers of Ontario
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SJI	Steel Joist Institute
SSPC	Steel Structures Painting Council
TSSA	Technical Standards & Safety Authority
TTMAC	Terrazzo, Tile and Marble Association of Canada
ULC	Underwriters Laboratories of Canada
UL	Underwriters Laboratories Inc. (USA)
WHMIS	Workplace Hazardous Materials Information System
WHPS	Warnock Hersey Professional Services

1.7. ABBREVIATIONS

1.7.1. Following abbreviations are used in Contract Documents:

<	angle
o	degree (angles)
µm	micrometre
#	number (before numerals)
A	ampere
AB	air barrier
ABS	Acrylonitrile butadiene styrene
A/C	air conditioning
AC	alternating current
ACP	acoustic panel
ACT	acoustic ceiling tile
AD	access door
ADJ	adjustable
AFF	Above Finished Floor
AFL	access flooring
ALUM or AL	aluminum
ANOD	anodized
AP	access panel
APPROX	approximate
ARCH	Architectural
A/VB	air/vapour barrier
AWG	American wire gauge

BH	bore hole
BLDG	building
BLKG	blocking
B.M	bench mark
BN	bull nose
BOL	bollard
B.RLG	bumper railing
BUR	built up roof
CABT	cabinet
CB	catch basin
C.BLK	concrete block
CEM	cement
CEM.BD	cement board
CEM.PL	cement plaster
cfs	cubic feet per second
CG	corner guard
CGL	clear glass
CH	coat hook
CHK.BD	chalk board
CHK.PL	checkered plate
CI	cast iron
CJ	control joint
℄	centreline
CLG	ceiling
CO	clean out
COL	column
CONC	concrete
CONSTR	construction
CONT	continuous
CPT or CP	carpet
CR	chair rail
CSK	countersunk
CT	ceramic tile
cu ft	cubic feet
cu yd	cubic yard
CW	curtain wall
c/w	complete with
DB	decibel
DC	direct current
DDC	Direct Digital Control
deg C	degree Celsius
deg F	degree Fahrenheit
DET	detail
DF	drinking fountain
DFT	dry film thickness
DG	double glazed
dia	diameter
DIN	Deutsches Institute for Normung
DN	down
DP	dampproof
DPC	dampproof course
DWG	Drawing

EF	epoxy flooring
EIFS	exterior insulation and finish system
EJ	expansion joint
EJC	expansion joint cover
ELEC	electric
ELEV	elevation
EMT	electro metallic tubing
EMS	Energy Management System
ENAM	enamel
ENCL	enclosure
ENT	entry
EP	electrical panel
EQUIP	equipment
ET	epoxy terrazzo
EXIST	existing
EXP	exposed
EXT	exterior
FA	fire alarm
FBD	fibreboard
FBR	face brick
FC	flexible coating
FD	floor drain
FHC	fire hose cabinet
FIN	finished
FL	floor
FOB	free on board
FP	fireproofing
fpm	feet per minute
FS	firestopping
(ft)(')	foot
FTG	footing
FWC	fabric wall covering
FWP	fiberglass wall protection
g	gram
ga	gauge
gal	gallon (Imperial measure)
GALV	galvanized
GASK	gasket
GB	gypsum board
GCB	glazed concrete block
GFI	ground fault interrupter
GFRG	glass fibre reinforced gypsum
GL	glass/glazing
GL.B	glass block
GRAN.A	granular A
GRAN.B	granular B
GRD	ground
GT	glass tile
GWG	georgian wired glass
ha	hectare
HB	hose bib
HC	hollow core
HDBD	hardboard
HM	hollow metal

HORIZ	horizontal
hp	horsepower
hr	hour
H/RAIL	handrail
H.RLG	hand railing
HS	hollow steel
HSS	hollow structural section
HT	height
HU	heating unit
HVAC	heating, ventilation and air conditioning
Hz	hertz
id	inside diameter
Igpd	gallons per day (Imperial measure)
Igph	gallons per hour (Imperial measure)
(in.)(")	inch
INCL	including
INSUL	insulation
INT	interior
INV	invert
IRGB	impact resistant gypsum board
J	joule
JT	joint
KD	knocked down
kg	kilogram
km	kilometre
kN	kilonewton
KO	knock out
kPa	kilopascal
l	litre
LAB	laboratory
LAV	lavatory
lb	pound
lb/ft	pound per foot
LED	light emitting diode
LH	Left Hand
LHR	Left Hand Reverse
lin ft	linear foot
LIN.MET	linear metal ceiling
LINO	linoleum
LL	lead lined
LS	light standard
l/s	litre per second
LSSJ	long span steel joist
LUM	luminous
m	metre
m^2	square metre
m^3	cubic metre
MAT'L	material
max	maximum
MB	marker board

MBF	thousand board feet
MCC	motor control centre
MECH	mechanical
MEZZ	mezzanine
min	minimum
misc	miscellaneous
ML	metal lath
mm	millimetre
MPa	megapascal
MRGB	moisture resistant gypsum board
MSDS	material safety data sheet
N	newton
NIC	Not in Contract
N.m	newton metre
No.	Number
NOM	nominal
NTS	not to scale
O/A	overall
oc	on centre
od	outside diameter
O/H	overhead
O&M	Operation and Maintenance
OPP	opposite
OWSJ	Open Web Steel Joist
oz	ounce
P	partition
Pa	Pascal
PA	public address system
P.CONC	precast concrete
PC	Pre-functional Checklists
PERP	perpendicular
PL	plate
PLAM	plastic laminate
PLAS	plaster
PLYWD	plywood
PM	pressed metal
PR	pair
PREFAB	prefabricated
PREFIN	prefinished
PRP	plastic resin paneling
PS	pressed steel
psi	pounds per square inch
PT	paint
PVC	polyvinyl chloride
QT	quarry tile
R	riser
RB	resilient base
R. CONC	reinforced concrete
RD	roof drain
REINF	reinforced
REQ'D	required
rev	revision
RH	Right Hand
RHR	Right Hand Reverse

RM	room
rpm	revolutions per minute
RPU	remote processor unit
RS	reducing strip
RT	rubber tile
RWL	rain water leader
RWP	rigid wall protection
s	second
SAN	sanitary
SAT	suspended acoustic tile
SB	sand blast
SC	solid core
SG	security glazing
SHV	sheet vinyl
SIM	similar
SLC	sealed concrete
SLR	sealer
SLT	slate tile
SN	stair nosing
SPEC	specification
SPR	sprinkler
SQ	square
sq ft	square feet
sq mi	square mile
sq yd	square yard
SR	seamless resin
SS	stainless steel
STL	steel
STRUCT	structural
SUSP	suspended
t	tonne
TB	tack board
TBR	to be removed
TCP/IP	Transmission Control Protocol/Internet Protocol
TEL	telephone
TEMP	temporary
TERR	terrazzo
T&G	tongue & groove
TYP	typical
U/C	under cut
U/G	under ground
U.O.N.	unless otherwise noted
UPS	uniterruptible power supply
U/S	under side
USgpm	gallons per minute (United States measure)
V	volt
VA	volt amphere
VAC	volt alternating current
VAV	Variable Air Volume
VDC	volt direct current
VB	vapour barrier
VCT	vinyl composite tile

VERT	vertical
VEST	vestibule
VOC	Volatile Organic Compound
Vrms	Voltage Regulator Module
VT	vinyl tile
vt ft	vertical foot
VWC	vinyl wall covering
VWP	vinyl wall protection
W	watt
WB	white board
W.CAB	writing cabinet
WC	water closet
WD	wood
WF	wide flange WGL
wired glass	
WM	wire mesh
WP	waterproofing
WPM	waterproof membrane
WPS	wall protection strip
WR	washroom
WVP	wood veneer paneling
WWF	welded wide flange
WWM	welded wire mesh
yd	yard
Z	zinc
ZCS	zinc coated steel

1.8. BUILDING SCIENCE PRINCIPLES

1.8.1. Obtain and read following references:

1.8.1.1.	NRCC 13487	- Walls Windows and Roofs for the Canadian Climate
1.8.1.2.	Canadian Building Digest 55	- Glazing Design
1.8.1.3.	Canadian Building Digest 96	- Use of Sealants
1.8.1.4.	Canadian Building Digest 155	- Joint Movement and Sealant Selection

1.9. QUALITY ASSURANCE

1.9.1. Study and be aware of principles discussed in above documents in order to understand their significance to the Contract Documents.

1.9.2. Some information in above reference documents may not be applicable to the Work and no recommendations or statement therein is a mandatory requirement of the Contract unless required by the Contract Documents.

1.10. TOLERANCES

1.10.1. Unless more stringent tolerances are required by a section of the Specifications or a referenced standard, meet following tolerances for installed work:

1.10.1.1. “plumb” means plumb within 3 mm in 3 m (1/8" in 10' - 0").

1.10.1.2. “level” means level within 3 mm in 3 m (1/8" in 10' - 0").

1.10.1.3. “square” means not in excess of 10 seconds, less or more than 90°.

1.10.1.4. “straight” means within 3 mm in 3 m (1/8" in 10' - 0"), under a 3 m (10' - 0") straightedge.

1.11. QUALIFICATIONS

1.11.1. For manufacturer’s, fabricator’s and installer’s qualifications, conform to requirements specified under respective trade section, as applicable. Where applicable, manufacturer’s field services shall be obtained as specified under respective trade section.

1.12. PROFESSIONAL ENGINEER’S QUALIFICATIONS

1.12.1. Employ a professional engineer registered to practice in Province of Ontario carrying a minimum $2,000,000.00 professional liability insurance to:

1.12.1.1. design components of the Work of this Project specific to their license to practice.

1.12.1.2. be responsible for determining sizes or other specific requirements within their license to practice in accordance with applicable codes and regulations.

1.12.1.3. be responsible for production and review of Shop Drawings.

1.12.1.4. inspect work of this Section during fabrication and erection/installation.

1.12.1.5. be responsible for stamping and signing each Shop Drawing and associated calculations performed.

1.12.1.6. provide site administration and inspection of this part of the Work.

1.12.1.7. Certification: Submit certification stating performance of engineered work will perform as required.

1.13. TESTING AGENCY QUALIFICATIONS

1.13.1. Conduct testing in accordance with requirements of OBC unless advised otherwise in the Contract Documents or by the Consultant. Obtain certification where required by applicable codes and standards.

1.13.2. Ensure testing agency is an independent testing agency with experience and capability to conduct testing indicated, as documented according to ASTM E329.

1.13.3. Qualifications of inspectors: Submit list of inspectors to be employed on this Contract and obtain the Consultant’s approval.

1.13.4. Ensure testing and inspection is performed by qualified inspectors and/or technologist certified by the Professional Engineer or performed directly by the Professional Engineer in conformance with applicable codes and certification programs.

1.13.5. Ensure inspectors are qualified to perform type of inspection or testing required.

1.13.6. Perform concrete testing using a testing company conforming to requirements of CSA A283 as required for this Contract. Inspection report format and distribution requirements will be established by the Consultant.

1.14. CONTRACTOR’S QUALIFICATIONS

1.14.1. Prior to commencement of the Work, establish quality control system protocols, rules, related chain of commands and commitment to provide quality work as intended in the Contract Documents for the Work.

1.14.2. Provide position Specification of quality control staff, shop and field supervisors complete with their skills, knowledge, duties and responsibilities.

1.15. SOURCE QUALITY CONTROL

1.15.1. Refer to respective Specification sections for source quality control requirements.

1.16. TESTING AND INSPECTION OF MECHANICAL AND ELECTRICAL SYSTEMS

1.16.1. Provide testing and inspection of mechanical and electrical systems as defined in the Contract Documents under trade sections of Divisions 21, 22, 23, 26, 27 and 28 respectively.

1.17. INTERIOR

1.17.1. Architectural millwork.

END OF SECTION

PART 1 GENERAL

1.1 Scope:

.1 The objective of this section is to provide guidance to the architect, mechanical designer, Contractor and Subcontractors for the purpose of implementing measures that help to maintain good indoor air quality (IAQ) during construction and post construction occupancy.

.2 It is applicable to all projects except those pursuing LEED® for New Construction certification. It is applicable to the design of other new facilities, and to upgrades, retrofits and expansions of existing facilities. Projects that are targeting LEED for New Construction certification shall follow LEED requirements.

.3 This Specification constitutes a compliant IAQ Management Plan (Plan) for the purpose of LEED for Existing Buildings: Operations and Maintenance 2009 Indoor Environmental Quality Credit 1.5 (EQc1.5) and shall be adhered to for all renovations and additions at the Administrative Centre.

.4 This Specification forms a Plan that shall be followed during demolition and construction and before occupancy to maximize air quality for construction workers and building occupants. This Plan contains the minimum requirements for construction and pre-occupancy phases. Additional measures to those listed may be required to accommodate Site specific IAQ issues or where

.1 the listed measures are not achieving the desired results. The Consultant may incorporate more stringent requirements into the project Specifications.

.5 This section should be read in conjunction with the program specific requirements where available.

1.2 Related Sections:

.1 01 60 00 – Product Requirements

.2 23 08 00 – HVAC System Commissioning

1.3 Reference Standards:

.1 All Products covered by this section shall be designed, manufactured, tested, installed and commissioned in accordance with industry applicable codes and standards including but not limited to:

.1 SMACNA – Sheet Metal and Air Conditioning Contractors National Association IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 08-2008.

.2 US EPA - United States Environmental Protection Agency Compendium of Methods for Determination of Air Pollutants in Indoor Air.

.3 ASHRAE – American Society of Heating, Refrigerating and Air- Conditioning Engineers Standard 52.2-1999 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

PART 2 DEMOLITION/CONSTRUCTION IAQ MANAGEMENT:

2.1 General Requirements:

.1 The purpose of this Plan is to identify potential sources of contamination at the Site and to minimize their impact through appropriate preventative or mitigative controls.

.2 Monitoring and documentation of implemented measures shall be required in order to demonstrate compliance with this Plan. Refer to Sections 4 and 5 of this Plan for details.

.3 This Plan includes the following types of approaches for the demolition and construction stages:

- heating, ventilation and air conditioning (HVAC) protection
- source control
- pathway interruption
- housekeeping
- scheduling
- occupant relocation

2.2 HVAC Protection:

.1 General

.1 All HVAC ductwork and equipment, including existing equipment, shall be protected from exposure to moisture and from collecting dust, debris, odours and other contaminants while demolition and construction activities are ongoing.

.2 The ends of all ductwork and openings in HVAC equipment are to be sealed tightly, whether they are installed or being stored prior to installation. All ductwork and equipment that is waiting to be installed must be kept off the floor a minimum of 75 mm.

.3 Permanent HVAC equipment shall not be used to dry out the building materials following the construction.

.4 Temporary ventilation and heating units should be used as needed while construction is ongoing.

.5 Prior to start-up, the Contractor shall verify that the HVAC systems are free of contamination.

.6 If after inspection by the Consultants or Region Project Manager the ductwork system is deemed to be unacceptable due to construction or demolition activities, the Contractor shall, at its cost and prior to operation or test and balance, clean systems and equipment including but not limited to ductwork (supply/return/exhaust), air handling equipment, plenums, terminal units, fans, dampers, grilles/registers/diffusers with high power vacuum machines. At the discretion of the Consultant, cleaning shall be performed in accordance with National Duct Cleaners Association (NADCA)

standards, and by agent specializing in this field of work, and a member in good standing with NADCA. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Submit report, verified by Testing and Balancing Agent, identifying the extent of duct system cleaning and certifying that NADCA standards have been met. Where a project does not have a Testing and Balancing Agent, the Region's Project Manager shall inspect the duct system cleaning.

.7 Provide adequate access into ductwork for cleaning purposes.

.8 Upon completion flush-out or successful IAQ testing, HVAC and lighting systems shall be returned to their designed or modified operation.

.2 Return/Exhaust Side Protection

.1 Immediately after installation, the open ends of return and exhaust ductwork shall be sealed with 6-mil plastic.

.2 Where feasible, permanent HVAC equipment shall not be operated during demolition.

.3 If air handlers must be used during demolition or construction, temporary filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 (as determined by ASHRAE 52.2-1999 with errata but without addenda) will be used at each return air grille or opening. These filters shall be inspected regularly during demolition and construction and be maintained in good condition. These filters shall be removed prior to occupancy.

.4 Where ceiling cavities are used as return air plenums, replace all missing ceiling tiles and seal all return air grilles and openings.

.5 Mechanical rooms with return-side equipment will not be used to store construction or waste materials.

.3 Supply Side Protection

.1 HVAC systems in areas where major demolition is scheduled should be de-energized where feasible.

.2 Equipment left in place during demolition and construction shall be wrapped in 6-mil plastic sheeting.

.3 Where HVAC systems are left off for the duration of construction, equipment, including VAV boxes, open ductwork, grilles and diffusers installed on the supply side of the HVAC systems shall be sealed with 6- mil plastic sheeting following installation.

.4 Filtration

.1 Where heavy dust loading is expected to impact operating HVAC systems, higher efficiency filters, such as MERV 13 shall be used to provide increased protection where minimum airflow can be maintained.

.2 Equipment filtration shall be replaced immediately prior to occupancy.

2.3 Source Control

.1 The most effective pollution control involves controlling the sources of contamination. The following practices will be implemented to manage the anticipated or potential contaminant sources:

.1 Contractor shall ensure that Subcontractors notify the Consultant when a construction activity is anticipated to cause contamination of the indoor air (i.e. excess dust, increased humidity, use of a product that will result in off-gassing to indoor air). Notification is to be made at least 48 hours before the planned commencement of the activity. The Contractor shall ensure that proper controls are in place.

.2 All adhesives, sealants, paints, coatings, flooring and wood products are to be low-emitting and shall meet the requirements of Section 01 60 00. Shop Drawings and/or Product data sheets identifying the Product's emissions and VOC content shall be submitted to the Consultant for review prior to installation or application. Products that have not been approved are to be removed from the Site.

.3 For potential off-gassing Products, i.e. cleaning solutions, Contractor shall ensure workers follow the safe material handling procedures specified for the Product. As necessary, additional ventilation or exhaust will be installed in the Place of the Work (see Section 2.4 Pathway Interruption).

.4 Contractors shall utilize demolition and construction techniques that minimize the release of contaminants, including airborne dust.

.5 Contractors shall utilize local dust extraction where possible to minimize airborne dust.

.6 Contractors are to immediately report any uncontrolled odours, dust or other contaminants identified in the Place of the Work to the York Region Site Contact, Project Manager and the Consultant.

.7 No vehicles are to idle in areas where emissions could be drawn into the building interior.

.8 Contractors will select electric powered rather than gasoline powered equipment to reduce emissions.

.9 Equipment will be turned off when not in use.

.10 Containers of wet products will be kept closed when not in use.

.11 Waste materials that release dust or odors will be covered or sealed.

2.4 Pathway Interruption

.1 Where a contaminant source(s) cannot be prevented, the following practices will be implemented:

.1 A negative pressure will be created in the Place of the Work subject to contamination (i.e. air borne dust particles and other related pollutants). The negative pressurization will reduce contamination of elsewhere in the Place of the Work. Pressurization will be achieved by the installation of portable fans. Air supply to the spaces will be 100% fresh air.

.2 Exhaust air from the temporary system will not be discharged where it can be drawn back into to the building (a minimum of 30 feet of separation is required to any building opening or air intake). Filtration for the temporary system may be required, depending on the controlled contaminant

.3 Barriers will be erected to contain the construction area.

.4 Wood cutting will be conducted behind barriers to control dust.

.5 Persons working near drywall dust must wear protective masks.

.6 Welding arc exhaust fumes will be controlled with a point source exhaust system.

.7 As required, equipment or activities will be moved outdoors and away from air intakes so as not to compromise indoor air quality.

2.5 Housekeeping Measures

.1 The following housekeeping practices will be implemented to manage accumulation of contaminants at the construction Site:

.1 Maintain a dry, clean workspace throughout construction.

.2 The Contractor shall visually inspect job Site daily for dust, dirt and water accumulation and take remedial action to correct deficiencies. Increase frequency of cleaning as required to maintain the Site in clean and dry condition.

.3 Wherever possible, an efficient dust collection method other than dry sweeping shall be used (damp rag, wet mop or vacuum).

.4 If dry sweeping is the only alternative, it shall be accompanied by a dust suppression agent. Vacuuming with HEPA filtered vacuum cleaners will be used to prevent aerosolization of settled dust.

.5 Waste products will be diverted to the appropriate enclosed waste bins or storage areas.

.6 Low emitting cleaners will be used that are Green Seal or Environmental Choice/Eco-Logo certified.

.7 All surfaces will be kept clean, including higher ledges and behind equipment or furniture.

.8 Building materials will be protected from precipitation and other contamination prior to installation. This includes protection of porous materials (i.e. insulation, drywall, and ceiling tile) from exposure to moisture and sources of contamination.

.9 Materials will not be stored directly on the floor. All materials will be elevated by a minimum of 75mm on pallets or by other means. Acceptable areas to store the building materials on-site will be identified by the York Region Project Manager.

.10 All coils, air filters, fans and duct work will remain clean during the installation and will be cleaned prior to performing testing, adjusting and balancing of systems.

.11 Any accumulation of water in the building will be immediately removed.

2.6 Scheduling

.1 The following activities relating to the sequencing of the installation will be implemented to manage potential contamination of porous materials:

.1 Contractor is to notify the Consultant if a Product application requires specific conditions to cure or dry.

.2 Porous building materials, those materials that have pores that will allow fluids or gasses to pass through; for this project include drywall, insulation, carpet and ceiling tiles, etc. Porous materials will be protected from exposure to precipitation, other moisture sources and VOCs (volatile organic compounds) contaminants. Protection measures may include:

1. Storing the porous Products in a location free from moisture and contamination sources prior to installation

.2 Installing porous Products utilizing recommended environmental conditions.

.3 Avoiding installation of Products in environments subject to high- VOCs emissions.

.4 Depending on the result of the visual assessment and moisture readings, dehumidification, heating and air circulation equipment may be installed in the applicable areas or alternative drying methods may be required.

2.7 Occupant Relocation

.1 Where the above or other strategies listed in the SMACNA IAQ Guidelines for Occupied Buildings Under Construction are unable to avoid potentially harmful exposure of building occupants to contaminants, occupants should be relocated for the periods where the air quality may be unacceptable. Temporary facilities shall have acceptable indoor air quality.

.2 Where hyper-sensitive individuals are concerned about indoor air quality during renovations, the Owner should consider options for relocating those individuals for the duration of the project.

2.8 Smoking

.1 Smoking shall always be prohibited from demolition or construction zones in Regional buildings.

.2 The Contractor shall post signage indicating the prohibition of smoking within the building and enforce the no-smoking policy.

.3 Smoking outside of the building on Region property shall only be permitted in a location identified in the Region's Smoke-Free Work Environment Policy and in no case shall be allowed within 9m of any building opening or air intake.

PART 3 IAQ MANAGEMENT BEFORE OCCUPANCY

3.1 General

.1 The impact of demolition and construction activities on building occupants shall be minimized prior to occupancy through an IAQ testing or flush-out procedure. IAQ testing is the preferred method. A flush-out of the construction area may be performed in lieu of testing at the discretion of the Consultant. Ventilation and exhaust capacities of the HVAC systems serving the constructed space as well as project schedule may preclude the flush-out option.

.2 Any costs associated with IAQ testing and/or flush-out shall be carried by the Contractor in their bid.

.3 All testing and compliance must be achieved prior to occupancy, the test shall be repeated as per below till the requirements are met. Contractor bears all associated cost with testing including retesting to satisfy requirements of credit.

.4 IAQ Testing

.1 IAQ testing protocols shall be consistent with the United States Environmental Protection Agency Compendium of Methods for Determination of Air Pollutants in Indoor Air.

.2 Testing shall be completed over the course of 1 normal operating day (additional days are acceptable if required due to sampling equipment limitations). Testing shall be performed by parties experienced in IAQ testing.

.3 All HVAC systems shall be fully operational in their normal operating mode during all testing periods.

.4 The number of sampling locations shall be not less than 6 (5 indoors and 1 outdoors) and there shall be a minimum of one sample per 1000 square meters of floor space, and one sample per floor.

.5 Sample locations shall be evenly distributed throughout the floor space.

.6 A minimum of one outdoor sample is required for each day of indoor testing, preferably from near the building's outdoor air intake if possible.

.7 Indoor testing is to be completed between 4 ft. and 7ft. from the floor to represent the breathing zone of occupants.

.8 The following table indicates contaminants to be measured as well as maximum allowable concentrations:

Contaminate	Maximum Concentration
Formaldehyde	27 parts per billion
Respirable particulate matter (PM10)	50 micrograms per cubic metre
Total volatile organic compounds (VOC's)	500 micrograms per cubic metre

Contaminate	Maximum Concentration
4-Phenycyclohexane (4-PC) [only required if carpets with styrene butadiene backing are installed]	6.5 micrograms per cubic metre
Carbon monoxide	9 parts per million and no greater than 2 parts per million above outdoor levels
Carbon dioxide	N/A - Measure only
Air temperature and relative humidity	N/A - Measure only

.9 For each building area where the maximum concentration limits are exceeded, identify and mitigate pollutant sources. Retest for any contaminant concentrations that were exceeded. Repeat process until all contaminant concentrations are within the maximum limits.

PART 4 DOCUMENTATION, INSPECTION AND MAINTENANCE OF PLAN

.1 Requests to modify management processes outlined in this Plan must be submitted in writing to the Owner for approval.

.2 Subcontractors' responsibilities regarding the indoor air quality management plan will be communicated by the Contractor at the weekly contractor Site meetings.

.3 A copy of the Plan shall be posted on Site in a location available to all workers.

.4 Contractor shall take digital photographs throughout the construction to capture the steps taken to comply with the requirements of this Specification. The Contractor shall forward photographs complete with date taken and identification of type of control measure highlighted.

.5 The Consultant will conduct Site reviews to ensure that the controls specified in the Plan are being implemented. Information from Contractor, Site inspection checklists and photographic documentation of the management controls will be collected to document compliance with this Specification. The Contractor shall be informed in writing of any deficiencies.

.6 Where deficiencies are identified by the Consultant, the Contractor shall take corrective action and provide photographic evidence of correction to the Consultant within 48 hours.

.7 The Contractor shall complete the Weekly Indoor Air Quality (IAQ) Management Checklist (Appendix B) on a weekly basis and provide copies to the Consultant.

.8 The Contractor shall complete the Filter Listing (Appendix C) at the end of the project and provide copies to the Consultant.

PART 5 ADDITIONAL REQUIREMENTS FOR LEED-EB: O&M CERTIFIED OR CANDIDATE BUILDINGS

.1 IAQ checklists will be completed on a weekly basis and copies provided to the Consultant. Any noted issues will be rectified immediately.

.2 The Contractor shall provide six photos weekly during construction—along with identification of the SMACNA approach featured in each photo. All SMACNA approaches used should be represented by at least one photo.

.3 Copies of all photographs, Project Indoor Air Quality (IAQ) Management Checklist, Weekly Indoor Air Quality (IAQ) Management Checklists, and Pre-Occupancy Filter List shall be provided to the Owner.

PART 6 MODIFICATIONS TO PLAN

.1 This Plan identifies the indoor air quality management controls to be implemented, maintained, and monitored on this project. However, it should be considered a “living document” that may be changed or adapted during the life of the project to be effective, subject to the below.

.2 Changes or adaptations to the Plan may occur if:

.1 Controls and/or practices are not achieving the desired results;

.2 Project scheduling prevents certain activities from being completed, and;

.3 An alternative procedure for control that meets the intent of the original Plan and is approved.by the Consultant.

APPENDIX A - Project Indoor Air Quality (IAQ) Management Checklist

Date:_____ Project Name:_____

Completed by:_____ Project Location:_____

DESIGN PHASE	Yes	No	N/A
Copy of this Design Standard provided to project consultants	❑	❑	
Project is a LEED-NC candidate **If "Yes", IAQ Management Plan to be developed by consultants to comply with LEED Requirements**.	❑	❑	
Consultant has specified Products and materials with low VOC's per Section 01 60 00 Product Requirements	❑	❑	
This project will use: a) this IAQ Management Plan as is. b) an IAQ Management Plan developed by the Consultant that is more stringent than this Plan.	❑ ❑	❑ ❑	
IAQ related Specifications have been incorporated into tender documents	❑	❑	
For renovations, Consultant has evaluated space for potential IAQ problems (e.g. musty smell, water damage. history of leaks)	❑	❑	❑
Building flush option has been reviewed for feasibility with system and project timing constraints and has been determined to be: a) feasible b) nonfeasible	 ❑ ❑		

CONSTRUCTION PHASE	Yes	No	N/A
Contractor has submitted Shop Drawings for all Products and materials that could impact IAQ (e.g. paints, adhesives, sealants, carpet, hard flooring, millwork, etc)	❑	❑	
Shop Drawings have been reviewed for compliance with Section 01 60 00 Product Requirements and/or Consultant's Specifications	❑	❑	
Weekly IAQ inspections and reports completed by the Contractor	❑	❑	
IAQ reviews have been conducted by Consultant	❑	❑	
Photos of IAQ measures have provided by the Contractor per Sections 4 and 5 of this Specification	❑	❑	
A decision has been made that prior to occupancy, the following will be conducted:			
a) Building/space flush-out	❑	❑	
b) IAQ Testing	❑	❑	

PRE-OCCUPANCY PHASE	Yes	No	N/A
All HVAC air filters replaced	❑	❑	
Final cleaning completed	❑	❑	
Building/space flush-out or IAQ testing conducted	❑	❑	
Description of procedures and results of flush-out or IAQ testing provided by the Contractor	❑	❑	

APPENDIX B - Weekly Indoor Air Quality (IAQ) Management Checklist

Date:_____ Project Name:_____

Completed by:_____ Project Location:_____

Signature:_____

	Yes	No	N/A	Comments or Action Items
HVAC PROTECTION				
Permanent HVAC equipment non-operational during construction	❑	❑	❑	
Temporary heating and ventilation units in use as required	❑	❑	❑	
Uninstalled HVAC equipment and ductwork protected	❑	❑	❑	
Installed HVAC equipment protected from dust	❑	❑	❑	
Open ends of installed return/exhaust air ductwork protected from dust	❑	❑	❑	
Temporary filters (min. MERV 8) installed on return air openings and grilles if HVAC system operational	❑	❑	❑	Complete Appendix C - Filter Listing
Ceiling tiles all in place if ceiling used as return air plenum	❑	❑	❑	
Open ends of installed supply air ductwork protected from dust	❑	❑	❑	
Supply side equipment (e.g. grilles/diffusers/VAV boxes) sealed	❑	❑	❑	
Filtration replaced immediately prior to occupancy	❑	❑	❑	
SOURCE CONTROL				
No sources of VOC emitting Products utilized within interior Work areas	❑	❑	❑	
No other contaminant sources utilized within interior Work areas (e.g. dust)	❑	❑	❑	
Construction equipment used in Work area utilizing fossil fuel	❑	❑	❑	
Other source of fossil fuel in interior Work area	❑	❑	❑	
Equipment off when not in use	❑	❑	❑	
Containers of wet Products sealed	❑	❑	❑	
Waste that can release dust or odours is in covered bins	❑	❑	❑	
Local dust extraction being used	❑	❑	❑	
Matt and/or grids at construction entrances	❑	❑	❑	
	Yes	No	N/A	Comments or Action Items

PATHWAY INTERRUPTION				
Negative pressurization in Work areas as necessary	❑	❑	❑	Describe:
Barrier(s) in place to contain construction area	❑	❑	❑	
HOUSEKEEPING				
Excess dust in Work areas	❑	❑	❑	
Standing water in Work areas	❑	❑	❑	
Low-emitting cleaners used	❑	❑	❑	
Stored porous building materials protected	❑	❑	❑	
Stored porous building materials raised off floor	❑	❑	❑	
Other building materials protected	❑	❑	❑	
SMOKING				
No-smoking signs posted	❑	❑	❑	
BUILDING FLUSH-OUT				
Flush-out taking place	❑	❑	❑	
Temporary filters and duct covering removed	❑	❑	❑	
Cleaning activities complete	❑	❑	❑	
Testing and balancing complete	❑	❑	❑	
IAQ TESTING				
IAQ testing taking place	❑	❑	❑	
DOCUMENTATION				
IAQ Management Plan posted on-site	❑	❑	❑	
Six photographs taken this inspection	❑	❑	❑	

Modifications to construction schedule affecting IAQ Plan:	
General comments on IAQ issues:	

APPENDIX C - Filter Listing

Date:_____ Project Name:_____

Completed by:_____ Project Location:_____

Signature: _____

	Yes	No	Comments or Action Items
Some or all of the permanent HVAC equipment was operational during construction	❑	❑	If Yes, complete table below

Filter Manufacturer	Filter Model#	Filter MERV Rating	Location of Installed Filter	Filter was Replaced Immediately Prior to Occupancy

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this section.

1.2. TEMPORARY UTILITIES

1.2.1. Temporary Protection: Provide and maintain following temporary protection at all times:

1.2.1.1. Window Openings: Translucent, weatherproof protection until windows and glazing are installed.

1.2.1.2. Door Openings: Minimum wood doors, frames, hinges, locks and bolts to exterior and interior to existing areas.

1.2.1.3. Air Intakes: Provide protection against infiltration of dirt, dust and other deleterious matter.

1.2.1.4. Temporary Dust Tight Partitions: Separate areas of work from occupied portions of building with temporary dust tight partitions constructed from floor to underside of structure. Construct temporary dust tight partitions as fire separations having a fire resistance rating of 1 hour consisting of 16 mm (5/8") gypsum board, both sides on steel stud partition conforming to ULC Design No. W407 and to ULC Design No. W408. Paint public sides of partitions with minimum 2 coats of low VOC paint in colours selected by the Consultant. Seal edges and joints to achieve positive protection. Provide lockable door(s) in temporary dust tight partition(s) where indicated on Drawings and extra key to the Consultant. Remove temporary dust tight partitions promptly when no longer required and Make Good adjacent surfaces. Hoarding/temporary dust tight partitions are to remain in-place unless noted otherwise.

1.2.1.5. Provide temporary dust tight partitions beyond those shown on Drawings where risk of falling objects exist, to protect the public and the Owner's personnel.

1.2.2. Temporary Fire Protection:

1.2.2.1. Provide and maintain sufficient temporary standpipes and connections, fire hose, valves, temporary cabinets and extinguishers, to comply with requirements of the governing Municipal and Provincial Authorities to satisfaction of the Consultant and local fire department and insurance Authorities in order to protect the property of the Owner against fire hazards during construction.

1.2.2.2. Adjust and modify temporary fire protection facilities to accommodate progress of the Work.

1.2.2.3. Bulk storage of flammable liquids and other hazardous materials is not allowed on the Site.

1.2.2.4. Bringing in, use and disposal of gasoline, benzine or other flammable materials must be handled with good and safe practice as required by Authorities Having Jurisdictions.

1.2.2.5. Maintain temporary fire protection systems in operation 24 hours a Day.

1.2.2.6. Provide and maintain temporary access routes to exits, clear and visibly identified, 24 hours a Day.

1.2.2.7. Take necessary precautions to eliminate fire hazards and to prevent damage to Work, building materials, equipment and other property, both public and private, having to do with the Work. Inspect Work of this Contract at least once a week for this purpose.

1.2.2.8. In areas of existing building being renovated and adjacent areas where affected by construction activities, make necessary adjustments and modifications to temporary fire protection as required during progress of the Work, removing such temporary modifications when the permanent system is installed and operating. Maintain all existing fire exits at all times.

1.2.2.9. Provide fire protection to satisfaction of the Consultant, to Authorities Having Jurisdiction and to insurance Authorities stipulated by Owner. Maintain in operation 24 hours a Day.

1.2.2.10. Provide and maintain free access from street to fire hydrants and to outside connections for standpipes or other fire extinguishing equipment, permanent or temporary; and maintain free access to control valves and hoses on fire lines within building and to all portable fire extinguishers. Ensure devices are visibly identified 24 hours a Day.

1.2.2.11. Provide and maintain in working order, suitable Underwriters' Laboratories of Canada labelled fire extinguishers and locate in prominent positions, to approval of Authorities Having Jurisdiction. Such extinguishers remain property of the Contractor. Remove from building at date of Substantial Performance of the Work.

1.2.2.12. Store and locate materials and equipment packed in cardboard cartons, wood crates and other combustible containers in orderly and accessible manner. Place approved types of fire fighting equipment in vicinity of materials or equipment packed in this type of crate or carton until permanent fire protection and equipment are available.

1.2.2.13. Store rags and waste containing oil, grease or other flammable materials in an approved metal container and remove from Site at end of each Working Day.

1.2.2.14. Only fire-resistant tarpaulins are permitted on Site.

1.2.2.15. Provide temporary standpipes as Work proceeds in accordance with the regulations under the *Occupational Health and Safety Act*, R.S.O. 1990, c. O.1, as amended.

1.2.2.16. In eliminating fire risks, or effectively controlling Site activities to minimize fire risk, observe following precautions as a minimum:

1.2.2.16.1. Prior to commencing Work in any area, ensure workers are acquainted with the location of all fire-fighting apparatus and are familiar with its proper use and apparatus is in good working order.

1.2.2.16.2. Stop all Work immediately when any deficiencies in fire protection are encountered after Work commences. Remedy all such deficiencies before resuming any other Work.

1.2.2.17. Notify the Newmarket Fire Department and the Consultant immediately should a fire of any nature occur whether the fire has been extinguished or not. Notify the Newmarket Fire Department and the Consultant of any fire alarm shutdowns; notify once fire alarm has been recertified and operational.

1.2.2.18. If the Contractor is the cause of a false alarm, it may be required to reimburse the Owner for any charges from the Newmarket Fire Department resulting from the false alarm.

1.2.2.19. Establish a logbook maintained by the Contractor which records all activity affecting the Owner's fire alarm system. The log book shall record the date, time, trade, worker's name, nature and location of Work performed, zone or zones affected, status of the system while Work was performed, time and date of completion of the operation, and status of the system upon completion of the Work. At the end of each Working Day, the Contractor shall review the log and sign indicating system is fully operational, except as recorded by the log. Inform the Owner of system status and which zones may be affected daily prior to the commencement of any new operation that affects the fire alarm system.

1.3. CONSTRUCTION FACILITIES

1.3.1. Contractor's Field Offices and Sheds:

1.3.1.1. Provide the Contractor's field offices and storage sheds within the Place of the Work only. Provide offices and sheds, properly painted and maintained.

1.3.1.2. Provide following field office facilities:

1.3.1.2.1. A room to accommodate [15] persons for Site conference and job meetings, heated and air conditioned to maintain a temperature of 21 deg C (70 deg F) +/-2 deg C (4 deg F).

1.3.1.2.2. Telephone services for the Contractor's own use.

1.3.1.2.3. "No Smoking" signs.

1.3.1.2.4. Provide proper flammable and explosive materials storage.

1.3.1.3. Floor Area: Minimum [250] sq. ft.

1.3.1.4. Facilities:

1.3.1.4.1. one desk (900 mm x 1500 mm (3' x 5') minimum).

1.3.1.4.2. one desk lamp (incandescent).

1.3.1.4.3. one smartphone.

1.3.1.4.4. three chairs.

1.3.1.4.5. one table and lamp.

1.3.1.4.6. one full-length, counter-height plan table with 3 plan drawers and storage under.

1.3.1.4.7. two tall stools.

1.3.1.4.8. one openable window to the outside (minimum 600 mm x 900 mm (2' x 3')).

1.3.1.5. Services:

1.3.1.5.1. electrical (minimum 3 receptacles).

1.3.1.5.2. lighting.

1.3.1.5.3. air conditioning.

1.3.2. Sanitary Facilities:

1.3.2.1. Existing toilet facilities may be used as directed provided they are kept clean and serviced. Repair damage to existing toilet facilities and clean before completion of the Work.

1.3.2.2. The Owner may back charge the Contractor for additional cleaning of facilities if not kept clean.

1.3.3. Garbage Removal: Do not use institutional garbage bin facilities for removal of construction rubbish and debris. Provide garbage bins and schedule pick up of garbage. Coordinate location of garbage bins with Consultant. Conform to the Consultant’s requirements. Repair damage to Site surface upon removal of garbage.

1.4. CONSTRUCTION AIDS

1.4.1. Scaffolding: Erect fixed or mobile scaffolding as applicable independent of walls. Use it in manner as to interfere as little as possible with other sections. When not in use, move it as necessary to permit installation of other work. Construct and maintain scaffolding in rigid, secure and safe manner. Remove it promptly when no longer required, and if required for longer than a Day, remove it at the end of each Day and store in secure place as directed.

1.5. VEHICULAR ACCESS AND PARKING

1.5.1. Parking for the Contractor's vehicles shall be arranged with the Consultant. The Owner will not be responsible for parking fines incurred by the Contractor, Subcontractors or their employees.

1.5.2. Do not be nuisance to public traffic any time. Manage construction traffic by using designated roads and by providing trained flag persons to direct public traffic as appropriate.

1.5.3. Existing Parking Facilities: .Parking is available to construction personnel. Arrangements must be made with Owner regarding the location of parking to be provided.

1.6. TEMPORARY CONTROLS

1.6.1. Pollution Control: Take appropriate dust control measures to avoid contamination of adjacent areas near Site from dust. Respond immediately to complaints of dust received from public, Authorities, or the Consultant. Keep public and private roads free of dust, mud and construction debris resulting from trucks employed on this project.

1.6.2. Noise and Vibration Control: Control noise and vibration generated by the Work. Respond immediately to complaints of noise and vibration received from public, Authorities or Consultant.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this section.

1.2. REFERENCES

1.2.1. Reference Standards:

1.2.1.1. ANSI/ASME B18.6.3-03(08) - Machine Screws and Machine Screw Nuts

1.2.1.2. CSA W47.1-03(08) - Certification of Companies for Fusion Welding of Steel

1.2.1.3. CSA W47.2-M87(08) - Certification of Companies for Fusion Welding of Aluminum

1.2.1.4. CSA W59-03 - Welded Steel Construction

1.2.1.5. CSA W59.2-M91(08) - Welded Aluminum Construction

1.2.1.6. CAN/ULC-S101-07 - Standard Methods of Fire Endurance Tests of Building Construction and Materials

1.2.1.7. CAN/ULC-S107-03 - Methods of Fire Tests of Roof Coverings

1.3. BASIC PRODUCT REQUIREMENTS

1.3.1. Material, Machinery, Equipment and Fixtures: Product employed in the Work shall be those which affect indoor air quality as little as possible. Provide adequate ventilation during installation of finishing materials to avoid effect on indoor air quality.

1.3.2. Material, plant, equipment and fixtures specified shall form basis of the Contract. Where more than 1 brand or manufacturer is named in Specifications, or on Drawings, Contractor shall have choice to use 1 of specified manufacturer or brand or Equivalent provided requirements of the Drawings and Specifications are met.

1.3.3. Ensure materials, plant, equipment and fixtures are not damaged or defective and of quality specified and compatible for purpose intended. If requested provide evidence as to type, source and quality. Remove and replace defective Products, at own expense, regardless of previous reviews and be responsible for delays and expenses caused thereby. Replace factory finished equipment, or parts thereof, whose paint finish is damaged and cannot be reasonably remedied by paint touch-up.

1.3.4. When conflict occurs between specified technical description and manufacturer's standard model numbers and/or manufacturer's printed description of given model number, technical description specified in the Contract Documents shall govern. Manufacturers shall make necessary modifications in their manufacturing methods to meet requirements specified.

1.3.5. Do not expose trademarks, labels and nameplates, including applied labels, in finished Work. Remove visible trademarks and labels except those which are giving operating instructions, which are essential to obtain identification of mechanical and electrical equipment for maintenance and replacement purposes and for mandatory fire ratings.

1.3.6. In general, the Owner retains right to select all choices available within specified Products colours, finishes and other options unless specified otherwise in the Contract Documents.

1.3.7. Toxic or Hazardous Substances and Materials:

1.3.7.1. Definitions:

1.3.7.1.1. Normal Mould Concentrations: Indoor concentrations of spores, hyphae and mycelia fragment (both airborne and on surfaces) that are similar in concentration and species population distribution that would be found outdoors in natural environment.

1.3.7.1.2. Mould Amplification: Growth or elevated population of mould (both airborne and on surfaces) including visible growth or staining on any building material. This amplification is most often caused by water damage to building materials.

1.3.7.3. Products and materials incorporated in the Work shall be as free as possible of noxious or toxic volatile emissions or emissions of irritating or toxic particles, so interior air of completed building is as pollution-free as possible. (For example, Products emitting benzene, mercury, lead or other known toxic compounds are not acceptable.)

1.3.8. Availability:

1.3.8.1. Immediately upon signing the Contract, review Product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of Products are likely or possible, or Products are no longer available, or a specified manufacturer is no longer in business, notify Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of the Work.

1.3.8.2. Products which are specified by their proprietary names, by part, or catalogue number form basis of the Contract. Alternative products, materials or manufacturers may be proposed by the Contractor during the course of the Contract. The Contractor shall demonstrate to the Consultant's satisfaction that the proposed substitutions are equivalent to the particular product, material or manufacturer prescribed by the Contract Documents and obtain the Consultant's written acceptance of the proposed alternative products prior to incorporating any substitutes into the Work.

1.3.8.3. In the event of failure to notify the Consultant at commencement of the Work of supply delays or Product availability issues, and should it subsequently appear that Work may be delayed for such reason, the Consultant reserves right to substitute more readily available Products of similar character, at no increase in the Contract Price.

1.3.8.4. No substitution of materials will be allowed on basis of long deliveries, unless such long delivery problems are identified during the tendering process.

1.3.9. Gauges:

1.3.9.1. Interpret gauges of uncoated steel sheet based on manufacturer's standard gauge (msg), stainless steel sheet based on "United States Standard Gauge (Revised)" and non-ferrous sheet metals based on "Brown & Sharpe Gauge". For galvanized steel sheet based on galvanized sheet gauge (ga).

1.3.9.2. Interpret gauges specified for wire as "Steel Standard" and for non-ferrous wire, as "American".

1.3.10. Fire Rating:

1.3.10.1. Where material, component or assembly is required to be fire rated, fire rating shall be determined on basis of results of tests conducted in conformance with CAN/ULC-S101 by 1 of following testing authorities acceptable to Authorities Having Jurisdiction:

1.3.10.1.1. Underwriters Laboratories of Canada (ULC); www.ulc.ca

1.3.10.1.2. Underwriters Laboratories Inc. (UL); www.ul.com

1.3.10.1.3. FM Global; www.allendale.com

1.3.10.1.4. National Research Council of Canada; www.nrc.ca

1.3.10.1.5. National Board of Fire Underwriters.

1.3.10.1.6. Warnock Hersey -ITS; www.etlsmeko.com

1.3.10.2. Where reference is made to only 1 testing authority, an equivalent fire rating as determined or listed by another of aforementioned testing authorities is acceptable if approved by Authorities Having Jurisdiction. Obtain and submit such approval of Authorities, in writing, when requesting acceptance of a proposed equivalent rating or test design.

1.3.11. Manufacturers' Written Instructions:

1.3.11.1. Unless specified otherwise, use each Product in accordance with manufacturer's published written instructions regarding handling, storage, preparation, methods of installation, protection and cleaning. Take into account Site conditions and provide ancillary Products or accessories.

1.3.11.2. Conform to manufacturer's recommended installation temperatures. If finishes are installed at temperatures different from operation or service temperatures, make provisions for expansion and contraction in service as acceptable to manufacturer and the Consultant. Repair resulting damage should expansion provisions prove inadequate.

1.3.11.3. Notify the Consultant, in writing, of conflicts between the Contract Documents and manufacturer's instructions, so the Consultant may establish course of action to be taken. If requested, make a copy of those instructions available at the Site.

1.3.11.4. Improper installation or erection of Products, due to failure to comply with these requirements, shall require removal and re-installation at no increase in the Contract Price.

1.3.11.5. Whenever specific reference to following manufacturer's directions or instructions is made in Specifications, upon request submit copies thereof for review by Consultant before commencing such Work.

1.3.12. Anchors and Fasteners:

1.3.12.1. Supply appropriate anchors, fasteners, accessories and adhesives required for fabrication and erection of the Work.

1.3.12.2. Unless specified otherwise use exposed metal fastenings and accessories of same texture, colour and finish as Product being fastened.

1.3.12.3. Use metal fastenings of same material as metal component being fastened, or of metal which will not generate electrolytic action and cause damage to fastening or metal component under moist conditions. In general use non-corrosive or hot dip galvanized steel anchors occurring on or in exterior wall, slab or other exterior locations, unless higher standard is indicated or specified.

1.3.12.4. Fastening devices or adhesives shall be of appropriate type, used in sufficient quantity and in such manner to provide positive, permanent fastening which will not shift, work loose or fail during occupancy of building due to vibration or other causes resulting from normal use of building. Install anchors at spacing to provide required load/stress carrying capacity. Do not use wood plugs.

1.3.12.5. Lay out fastenings neatly, evenly spaced and aligned. Keep exposed fastenings to minimum.

1.3.12.6. Supply adequate instructions and templates and, if necessary supervise installation, where fastenings or accessories for sections which are required to be built into work of other sections.

1.3.12.7. Do not use fastenings which will cause spalling, cracking, or deformation or deterioration of material being fastened by or to.

1.3.12.8. Do not use powder actuated fastening devices, which are used in tension, without approval. Take stringent safety precautions when using powder actuated fastenings. Use only low velocity plunger-type devices.

1.3.12.9. Use adhesives specified, or if not specified, those recommended by manufacturer of materials involved, compatible with materials to be joined, and effective in forming permanent joint of adequate strength.

1.3.12.10. Use screws, nails, staples and other similar driven fasteners suitable to materials to be joined and to conditions under which they are installed and used. Ensure in finished work, fasteners are sized to take durable hold under stress to be encountered without damage to, or weakening of, elements secured together and fastenings will not corrode or cause staining of exposed surfaces.

1.3.12.11. Security Screws: Complying with ANSI/ASME B18.6.3; provide only tamper-resistant Torx-Plus® or Equivalent break off type screws as specified and noted on Drawings. Provide flathead security screws where Torx-Plus® or Equivalent break off is indicated to be counter sunk otherwise provide only trusshead or buttonhead for Torx-Plus® or equivalent and only roundhead for break off type. Torx-Plus® Temper resistant screws or Equivalent with heads having a deep hex-lobular recess with a solid post formed in the centre requiring a special metal driver to install or remove screw. Fasteners and tools shall be of type produced by licensed manufacturer. Break off head security screws with drive heads having an additional hexagonal shaped head designed to break off after installation at a predetermined torque level. Grind remaining portion of neck smooth after hex-head is broken off. Acceptable manufacturers, Temper Proof Screws Inc. or Folger Adam Security Inc, or Sentry Security Fasteners, Inc. or Temper Proof Screw Co. or Equivalent.

1.3.12.12. Do brazing or soldering to form durable connections of strength adequate to resist stresses to be encountered without deformation of elements joined. Prepare base metals and use methods and materials to ensure clean joint, and to prevent staining, corrosion, discolouration, deformation or other damage to the finished Work.

1.3.12.13. Do welding to CSA W59 for steel and to CSA W59.2-M for aluminum, unless specified otherwise. Have welding performed by companies certified operatives to CSA W47.1 or CSA W47.2-M.

1.3.12.14. Provide accessory items or materials required, such as brackets, cleats, connectors, sealants, lubricants, cleaners, protection and similar items, whether specified or not, so the Work is complete and performs as required.

1.3.13. Built in Items: Provide and coordinate location of chases, slots and reglets including frames, sleeves, inserts, anchors, fasteners and bolts, forms and templates.

1.3.14. Patents: Verify existence or exclusivity of patent licenses for Products prior to installation.

1.3.15. Trademarks and Labels: Do not expose trademarks and labels, including applied labels, in finished Work. Remove visible trademarks and labels except those which are essential to obtain identification of mechanical and electrical equipment for maintenance and replacement purposes and for mandatory fire ratings.

1.3.16. Barrier Free Design Requirements:

1.3.16.1. Conform to the latest edition of the Ontario Building Code requirements for barrier free installations.

1.3.16.2. Install switches, telephones, fire-alarm pull stations, and other equipment and devices requiring accessibility by building staff and public, excluding mechanical and electrical room installations, to meet barrier-free requirements. If there is conflict between this requirement and any other Building Code requirement bring to attention of Consultant prior to installation.

1.4. PRODUCT DELIVERY, HANDLING AND STORAGE

1.4.1. Package, crate and brace Products to prevent damage during delivery, storage and handling.

1.4.2. Provide protection to finished surfaces to prevent damage during delivery, storage and handling.

1.4.3. Store packaged materials in original, undamaged condition with manufacturers' labels and seals intact.

1.4.4. Handle and store materials in accordance with manufacturers' and Suppliers' recommendations, in protected locations.

1.4.5. Store materials susceptible to environmental damage in weather-tight enclosures, raised clear of the ground and protected from weather, dampness and deterioration.

1.4.6. Replace Products damaged during delivery to the Place of the Work, storage, handling and installation.

1.4.7. Conform to written procedures for safe handling, storage and use of noxious and hazardous materials including special precaution, safe clean-up and disposal procedures.

1.4.8. Mould Control during Product Storage and Handling:

1.4.8.1. Do not bring building Products onto Site containing toxic moulds.

1.4.8.2. Exercise continuous quality control and enforce mould control requirements upon Subcontractors and establish proper Product storage and delivery sequence to protect Products from weather and other exposures conducive to mould growth.

1.4.8.3. Take special care while handling and storing materials, without limitation, such as particleboard, plywood, cellulose materials, wallpaper, ceiling panels, gypsum boards and insulation with kraft paper back up.

1.4.8.4. Monitor humidity levels and provide adequate ventilation in storage areas. Be watchful of any moisture condition in storage areas. Do not use materials which have been damaged by exposure to moisture and/or showing signs of mould growth.

1.4.8.5. Take measures during Product storage and handling to provide mould free finished construction.

1.5. CONCEALMENT OF SERVICES

1.5.1. Conceal pipes, service lines and ducts in chases, behind furring or above ceilings, except where they are indicated as being exposed to view. Where no ceiling is provided, such items may be exposed, but must be neatly and logically arranged.

1.6. MANUFACTURED ITEMS

1.6.1. Where a conflict occurs between specified technical description and manufacturer's standard model numbers and/or manufacturer's printed description of given model number, technical description specified herein governs. The Contractor shall ensure that manufacturers make necessary modifications in their manufacturing methods to meet all aspects of these Specifications.

END OF SECTION

D

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this Section.

1.2. REFERENCES

1.2.1. Reference Standards:

1.2.1.1. ASTM C843-99) - Specification for Application of Gypsum Veneer Plaster

1.2.1.2. ASTM C926-99 - Specification for Application of Portland Cement-Based Plaster

1.3. PROFESSIONAL ENGINEERS' SERVICE

1.3.1. Obtain full time engineering service from Professional Engineer licensed to practice in the Province of Ontario in applicable discipline. Engineering service shall include without limitation, design of structural elements and full inspection services during fabrication, erection and administration during construction.

1.4. DESIGN INTEGRITY AND ARCHITECTURAL REQUIREMENTS

1.4.1. Continuity of Fire Separations:

1.4.1.1. Conform to following requirements to maintain continuity of fire separations:

1.4.1.1.1. Fire separations may be pierced by openings for electrical and similar service outlets provided such boxes are noncombustible and are tightly fitted.

1.4.1.1.2. Where a fire separation is required to be of noncombustible construction terminates at exterior wall, underside of floor, ceiling or roof structures and at floors, opening shall be fire stopped with a ULC approved Listed material.

1.4.1.2. Combustible members, fastenings and like shall not be used to anchor fixtures to fire separations.

1.4.1.3. Continuity of Sound Attenuating Partitions and Ceilings: Maintain acoustical value of partitions and sound attenuated ceilings by careful location and treatment of ducts, grilles, diffusers and similar mechanical devices and of electrical outlets, boxes and similar electrical devices. Where electrical boxes are situated back-to-back, serving each side of partition, locate them at recommended distance apart laterally and if interconnected, use flexible connections.

1.4.1.4. Holes Through Walls, Floors and Roof: Ensure holes through walls, floors and roof are provided by trades as specified and are complete with sleeves, packing insulation, fire stopping and sealant as required for each particular condition.

1.5. EXAMINATION

1.5.1. Acceptance of Conditions:

1.5.1.1. Examine Site at no cost or risk to the Owner for all matters relating to the Work, extent of the Work, means of access and egress, all obstacles, rights and interests of other parties which may be interfered with during execution of the Work, all conditions and limitations Contractor to take into consideration in performing the Work, including obstructions, existing structures or facilities, local conditions, actual levels, character and nature of project and any other consideration which may affect performance of the Work.

1.5.1.2. Where available obtain existing Drawings pertaining existing building layout, architectural, structural, mechanical, electrical details and assess impact in performing the Work of this Contract.

1.5.1.3. Examine existing conditions at no additional cost to the Owner, surfaces and substrata upon which Work depends. Drawings are, in part, diagrammatic and are intended to convey scope of Work and indicate general and approximate location, arrangement and sizes of fixtures, equipment, ducts, piping, conduit and outlets and similar items. Obtain more accurate information about locations, arrangement and sizes from study and coordination of the Drawings, including Shop Drawings and manufacturers' literature and become familiar with conditions and spaces affecting these matters before proceeding with the Work.

1.5.1.4. Ensure each Subcontractor has full understanding of extent of its Work. Report in writing defects in such Work and notify Subcontractors responsible for unfavourable and unsatisfactory conditions. Do not commence the Work until unsatisfactory conditions have been corrected. Verify corrected Work prior to commencing Work. Execution and application of Work shall be deemed acceptance of Work upon which Work depends.

1.5.2. Existing Activities, Facilities and Conditions:

1.5.2.1. Existing institution may be in operation throughout the Work. Do not interrupt existing services, facilities and activities at complex, except for authorized and scheduled interruptions of services acceptable to the Owner. Obtain written permission of the Owner a minimum of 3 Working Days in advance of any shutdown required for tie-in of new construction systems. Written requests for shutdown permission shall clearly identify exact extent of systems affected, time and duration.

1.5.2.2. Make necessary enquiries to determine locations of existing services such as hydro, telephone, water, natural gas, sewer and like. Make arrangements and pay all costs to temporarily relocate, shore, underpin or in any way accommodate existing services which affect the Work of this Contract.

1.5.2.3. Should any piping, sewers, cables, or similar services be encountered during Work of this Contract that are not known from the Owner's and utilities companies' records, notify Consultant and do not proceed with removal or cutting until directed.

1.5.2.4. Protect and maintain in operation all existing services and systems. When removing or altering existing services, make safe, secure and maintain seals as applicable for all lines affected.

1.5.2.5. Perform required shutdowns outside of normal working hours at no increase in cost if requested by the Owner.

1.6. MATERIALS

1.6.1. Where Specification requirements include design of a Product or system, and minimum material requirements are specified, design of such Product or system shall employ materials specified within applicable section. Where materials or components are not specified, the Contractor shall augment materials with those of its choice within applicable Municipal, Federal and Provincial regulatory limitations while maintaining integrity of design and architectural requirements.

1.6.2. Defective Products, whenever identified prior to completion of the Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is a precaution against oversight or error. Remove and replace defective and/or damaged Products at own expense and be responsible for delays and expenses caused by rejection.

1.6.3. Ensure new materials used to repair damage are compatible with existing Work.

1.7. PREPARATION

1.7.1. Planning, Scheduling & Coordination of Alterations:

1.7.1.1. Plan and schedule alterations to accommodate anticipated difficulties, indicated on and inferable from the Contract Documents.

1.7.1.2. Plan, schedule and coordinate alterations to accommodate on-going operations of the Owner with minimal disruption.

1.7.1.3. Plan, schedule and coordinate alterations, required in the Owner-occupied spaces or adjoining or below the Place of the Work, on a room-by-room basis and in accordance with a schedule mutually agreed upon with the Owner. Requests for access to occupied areas shall be made to the Owner a minimum of 1 week in advance of requested access time.

1.7.1.4. Co-ordinate alterations with Other Contractors and proceed with the Work expeditiously.

1.8. EXECUTION

1.8.1. Existing Conditions:

1.8.1.1. Make Good surfaces and finishes damaged or disturbed due to the Work of this Contract to match existing. Ensure materials used to repair damage are compatible with existing Work.

1.8.1.2. Restore the Site to condition equal to or, if specified elsewhere, to condition better than existing conditions.

1.8.1.3. Restore lands outside of limits of Work which are disturbed due to the Work to original condition in addition to complying with requirements of the General Conditions of the Contract.

1.8.2. Installation:

1.8.2.1. Except where specified otherwise, use each Product in accordance with manufacturer's published or written instructions, Specifications or recommendations regarding handling, storage, preparation, Site conditions, ancillary Products or accessories, methods of installation, protection and cleaning. Submit copy of such instructions and indicate if and where there is discrepancy between them and requirements of Specifications and obtain direction from Consultant if necessary.

1.8.2.2. Whenever specific reference to following manufacturer's directions or instructions is made in Specifications, submit copies as requested thereof for review before commencing such Work.

1.8.2.3. Do the Work in accordance with industry practice for type of Work unless the Contract Documents stipulate more precise requirements. Do not let unskilled, incompetent workers perform Work.

1.8.2.4. Do the Work in neat and careful manner to retain the Work plumb, square and straight.

1.8.2.5. Ensure the Work is properly related to form close joints and appropriately aligned junctions, edges and surfaces and is free of warp, twist, wind, wave or other irregularities.

1.8.2.6. When required by the Specifications or by manufacturer's recommendations, have manufacturer, Supplier or accredited agent, inspect Work which incorporates their Products.

1.8.2.7. Do not permit materials to come in contact with other materials whether in presence of moisture or otherwise if conditions will result in corrosion, stain or discolouration or deterioration of the completed Work. Provide compatible, durable separators where such contact is unavoidable.

1.8.2.8. Intentionally deleted.

1.8.2.9. Load no part of structure during construction with load greater than it is calculated to bear safely when completed. Make every temporary support as strong as permanent support. Place no load on concrete structure until it has sufficient strength to safely carry such load.

1.8.2.10. Conceal pipes, ducts, conduits, tubing, wiring and other items requiring concealment in floor, wall and ceiling construction of finished areas except where indicated or specified otherwise in the Contract Documents. If in doubt as to method of concealment, or intention of the Contract Documents in this connection, request clarification from the Consultant before proceeding with Work in question.

1.8.2.11. Install and arrange fixtures, equipment, ducts, piping and conduit to conserve as much headroom and space as possible, and avoid interference and obstruction of access. Observe good installation practice for safety, access, maintenance and follow manufacturer's recommendations. Location of fixtures, access panels, outlets and mechanical and electrical components indicated are approximate.

1.8.2.12. If requested by the Consultant, and before installation, relocate equipment, services, doors, openings, furring and other work at no additional cost to the Owner; provided such relocation involves only reasonable minor adjustments and reasonable advance notice is given in writing. Ensure identification of electrical and mechanical system installations and other automated systems or equipment shall be provided in accordance with the Contract Documents.

1.9. ALTERATIONS AND REPAIRS

1.9.1. Perform Work in a manner such as to cause a minimum of noise and interference to use of existing premises and services. Provide maximum safety for occupants during Work.

1.9.2. Throughout entire construction period, provide proper and safe means of fire exit from all zones of existing building at all times, to approval of Authorities Having Jurisdiction.

1.9.3. Wherever it becomes necessary to cut or interfere in any manner with existing apparatus for short periods of time, do Work at such times as agreed upon with the Owner and the Consultant.

1.9.4. If unscheduled disturbance to use of existing premises and services is required to complete Work, inform the Owner with advance notice of a minimum of 1 week. Provide information of requirements and perform Work at times directed by the Owner.

1.9.5. Make provisions to join new Work to existing and to install new supporting members, anchors and other items necessary for completion of Work. Provide temporary bracing where required.

1.9.6. Proceed with demolition of or alterations to any portion of existing building only after approval of the Consultant has been obtained and after weather tight and dustproof screens have been erected to provide thorough protection to adjoining areas and rooms.

1.9.7. When permission has been granted to proceed with alterations in existing building, carry out Work

expeditiously and continuously to completion.

1.9.8. Carry out Work so as to minimize dust migration. Protect items sensitive to and which could be damaged by dust. Where practical, keep demolition areas wetted.

1.9.9. During performance of Work, adequately protect Work completed and in progress, and existing work to remain, such as floors, finishes, trim and similar components, as completely as possible to minimize replacement of damaged Work by each Subcontractor and trade. Work damaged or defaced due to failure to provide adequate protection shall be repaired, or removed and replaced as directed by Consultant.

1.9.10. Properly coordinate Work of various sections and trades. Take into consideration existing installations to assure best arrangement of pipes, conduits, ducts and mechanical, electrical and other equipment and items, in available space. Under no circumstances will any extra payment be allowed due to failure by the Contractor to coordinate Work.

1.9.11. Remove, store and reinstall existing fixed equipment, fixtures and components which interfere with construction Work.

1.9.12. Cutting, patching and making good of existing work to accommodate new Work and requirements specified under other sections shall be done in conjunction with Work specified herein. Coordinate such Work.

1.9.13. Employ tradesmen qualified in Work being cut and patched to perform Work correctly and skillfully.

1.9.14. Do not undermine, damage or endanger existing structure, footings, foundations, pipe lines, electrical conduit and wiring by digging, cutting or any other operation in performance of Work of this Contract. Immediately repair and Make Good existing work so affected, including working after regular working hours, to the Consultant's approval, recommendation and satisfaction at no additional cost to the Owner.

1.9.15. Cut off, cap, divert or remove existing services in areas being altered which are affected by changes as required or as directed by municipal Authorities and utility company concerned and the Consultant. Protect and maintain active services to existing building.

1.9.16. Where new Work connects with existing and where existing work is altered, perform necessary cutting and fitting required to make satisfactory connections with existing work under this Contract, so as to leave entire Work in a finished condition. Match new Work exactly with existing work in material, form, construction and finish unless otherwise noted or specified. Make joining Work inconspicuous.

1.9.17. Make Good materials, surfaces, and finishes damaged or disturbed due to Work of this Contract.

1.9.18. Except where structural requirements are indicated on the Drawings, do not cut, drill or sleeve load bearing members without first obtaining the Consultant's written authorization for each condition.

1.9.19. Perform drilling of existing work carefully, leaving a clean hole no larger than required.

1.9.20. Make cuts clean and true with smooth edges. Fit units to tolerances established by existing work and in conformance with best standard practice for applicable class of Work.

1.9.21. Fill unused and unfilled sleeves and holes in non-fire rated floors and partitions not otherwise filled, by approved means. If unused sleeve is in fire or sound barrier, fill in manner to restore or maintain fire or sound barrier rating. Filling of openings in fire rated floors and partitions specified under Section 07 84 00 - Firestopping and Smoke Seals.

1.9.22. If non-designated and unclassified sprayed fire resisting, sound absorbing, or insulation applications are encountered, inform the Consultant for examination and instructions. Restore damaged non-asbestos type fireproofing to original condition before covering with finishes.

1.9.23. Work shown on the Drawings, schedules and Specifications may or may not be all Work required to be

done in existing building. Make Good and execute all necessary Work including incidentals to make a complete job of alterations Work.

1.9.24. Cutting and Patching - General:

1.9.24.1. Coordinate openings with Subcontractors to avoid unnecessary cutting and patching.

1.9.24.2. Coordinate cutting and patching with Subcontractors to avoid unscheduled cutting and patching Work.

1.9.24.3. Prior to cutting, sawing, breaking and core drilling provide integrated penetrating system to detect conduits, cables, pipes and similar items in suspended floor slabs and in walls where applicable. Carry out scanning to detect location of live power or energy transmitted from power source such as feeds for electric motors, compressors, heating and cooling systems prior to core drilling and sawing of typical slab on grade.

1.9.24.4. Prior to cutting, sawing, breaking and core drilling through concrete, structural masonry and steel and load bearing members, including floors, ceilings, columns, beams and walls, obtain the Consultant's written acceptance.

1.9.24.5. Execute cutting neatly and carefully, no larger than necessary, employing workers skilled in erection of the part of the Work being cut.

1.9.24.6. Patch parts of the Work to match adjacent construction and finishes unless otherwise specified or indicated on the Drawings.

1.9.24.7. Provide patching Products equal to existing finishes.

1.9.24.8. Join new Work to existing in neat, accurate manner.

1.9.24.9. Provide soundproof interior junctions.

1.9.24.10. Design and provide permanent and temporary reinforcement and supports, as directed by the Consultant.

1.9.24.11. Maintain fire separations and provide fire and smoke penetration sealants in cut and patched parts of the Work.

1.9.24.12. Unless otherwise indicated in the Contract Documents, run piping, ducts and conduit in ceilings and furred spaces. Bury conduit in walls.

1.9.24.13. Saw-cut floors, walls and ceilings accurately. Provide holes and openings no larger than necessary to minimize damage. Core drill circular holes in concrete. Accurately cut new openings for electrical outlets and other recessed items in walls.

1.9.24.14. After cutting and patching is completed, re-finish surfaces to minimum 100 mm (4") outside patch perimeter, floor to ceiling and to nearest break in wall surfaces, such as inside and outside corners. Match patch finish to existing adjacent surfaces to completely conceal patch.

1.9.25. Cutting and Patching - Fire Separation Alterations:

1.9.25.1. Maintain fire separations for duration of the work of this section.

1.9.25.2. Provide fire and smoke penetration sealants at alterations and repairs in accordance with Section 07 84 00 - Firestopping And Smoke Seals.

1.9.25.3. Provide continuous and solid framing, blocking or masonry work around service penetrations through fire separations in accordance with the fire penetration sealant design to maintain the continuity of the fire separation.

1.9.26. Cutting and Patching - Mechanical and Electrical Alterations:

1.9.26.1. Provide cutting and patching required for access to execute services alterations. Conceal capped services unless specifically indicated to remain exposed. Patch to conceal altered and capped services.

1.9.26.2. Provide cutting, e.g., core drilling of existing concrete and masonry walls and slabs, required to pass services through existing assemblies to accommodate alterations.

1.9.27. Removal of Flooring and Preparation of Substrate:

1.9.27.1. Remove flooring and adhesive/setting bed materials completely, down to concrete substrate.

1.9.27.2. Remove ridges and trowel marks and scrape substrate to a smooth level surface.

1.9.27.3. Fill new and existing depressions, dished areas, low spots, voids, gaps, cracks, joints, holes and other substrate defects with skim coat and self-leveling topping to achieve a flat substrate to within following tolerances:

1.9.27.3.1. 3 mm (1/8") total maximum deviation +/- along a 3000 mm (10') straight edge applied omni-directionally over entire floor area.

1.9.27.4. Provide skim coats, primers and bonding agent slurries to neutralize residue adhesives and setting beds and to provide a suitable substrate to receive scheduled floorings.

1.9.28. Removal of Existing Carpet Adhesive and Setting Bed:

1.9.28.1. Prepare existing surface acceptable to the Consultant, suitable and compatible with subsequent applied underlayment or applied finish. Remove existing flooring and bases where indicated in the Drawings unless specified to be carried out under other sections. Remove carpet and adhesive/setting bed materials completely, down to concrete substrate. Prepare, mix and apply coats to neutralize residues adhesives and setting beds and to provide suitable substrate to receive scheduled flooring in accordance with manufacturer's instructions.

1.9.28.2. Shot blast existing concrete or prepare existing surfaces by or means acceptable to the Consultant. Level slabs as required to accommodate flooring with self-leveling underlayment to suit application. Grind existing concrete slab as required, clean surfaces and remove residue adhesives. Remove ridges and trowel marks and scrape substrate to a smooth level surface. Surfaces shall be clean, free of gouges, matter detrimental to bond of underlayment and flooring and be ready to receive underlayment and flooring. Prepare for flush application of new flooring material.

1.9.28.3. Fill new and existing depressions, dished areas, low spots, voids, gaps, cracks, joints, holes and other substrate defects with skim coat and self-leveling topping to achieve a flat substrate to within following tolerances: 3 mm (1/8") total maximum deviation +/- along 3000 mm (10') straight edge applied omni directionally over entire floor area.

1.9.28.4. Underlayment shall have compressive strength of 4000 psi after 28 Days and tolerance specified above.

1.9.28.5. Coordinate with substrate preparation specified in floor finish section.

1.9.29. Temporary Ceiling Removal:

1.9.29.1. Coordinate with electrical and mechanical trades to assess complete scope of temporary ceiling removals to allow for feeder runs and like by those sections (extent of ceiling removal has not been shown on architectural plans).

1.9.29.2. Provide temporary protection, signage and barriers to protect others.

1.9.29.3. Remove tile, panels and tee bar suspension from area required by other trades.

1.9.29.4. Upon completion of Work of other trades and all required inspections, replace tee-bar and acoustic tile. Where tile or tee-bar are damaged, bent, discoloured, scratched or otherwise appear of lesser quality than surrounding area, replace with new material.

1.9.29.5. Plaster ceilings in existing institution may be forming part of membrane fire separation having a fire resistance rating. Verify and maintain existing fire rating.

1.9.29.6. Remove and replace gypsum board bulkheads and ceilings in areas designated and as required. Make Good and match existing finishes.

1.10. CLEANING

1.10.1. Progress Cleaning:

1.10.1.1. Keep access areas to Work in tidy condition, free from accumulation of waste and debris during construction and on completion, other than caused by the Owner's crew or Other Contractors. Do not dispose of volatile fluid wastes (such as mineral spirits, oil or paint thinner) in storm or sanitary sewer systems or into streams or waterways.

1.10.1.2. Keep Site and building, including concealed spaces, free from accumulation of dirt, debris, garbage and excess material. Remove oily rags and waste from premises at close of each Day Work is performed, or more often if required.

1.10.1.3. Remove rubbish and surplus materials promptly and dispose of in a legal manner. Do not allow scrap piles to accumulate. Do not permit fires.

1.10.1.4. Lower waste materials in a controlled manner with minimum handling; do not drop or throw materials from heights. Schedule cleaning operations so dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces. Sprinkle dusty debris with water.

1.10.1.5. Sweep adjacent roads and sidewalks daily to remove dirt and clods of earth deposited on adjacent public and private properties by construction traffic.

1.10.1.6. Vacuum-clean interior areas prior to start of finish Work, maintain areas free of dust and other contaminants during finishing operations.

1.10.2. Final Cleaning:

1.10.2.1. Prior to occupancy, clean the Place of the Work thoroughly, free of rubbish and surplus material. Dispose of rubbish and debris. Vacate the Place of the Work in a clean and tidy condition satisfactory to the Consultant.

1.10.2.2. Prior to cleaning, submit to the Consultant a complete list of manufacturers' cleaning/ maintenance instructions for all components of the Work.

1.10.2.3. Final finishing is in addition to and compatible with cleaning and finishing specified in Specification sections.

1.10.2.4. Clean new and existing components in accordance with manufacturers' recommendations including, but not limited to:

1.10.2.4.1. Floors.

1.10.2.4.2. tile/vinyl flooring: Sweep floor free of debris; clean corners and base

boards free of marks and dirt. Scrub new flooring using appropriate solutions to remove factory installed protective coatings. Strip existing flooring using appropriate chemical solution to remove any existing floor

finish coating and base seal coatings. Apply to new and existing flooring 2 coats of sealer recommended by manufacturer of flooring materials. Let floor completely dry between coats. Use prime quality top line Products. Do not apply finish to baseboards.

1.10.2.4.3. vacuum carpet flooring using power brush equipped vacuum cleaner. Remove stains using approved stain removal methodology. Where carpet is exposed to extensive dry wall dust and other fine dust particles, carpet shall be pile lifted using rotary pile lifting machine. In addition, carpet shall be cleaned using extraction method approved by manufacturer.

1.10.2.4.4. walls shall be completely dusted and all marks removed. Where necessary wall shall be washed if painting is not an option.

1.10.2.4.5. ceilings.

1.10.2.4.6. window coverings.

1.10.2.4.7. doors, windows and frames.

1.10.2.4.8. exposed interior and exterior glazed surfaces.

1.10.2.4.9. hardware.

1.10.2.4.10. mechanical and electrical fixtures and equipment.

1.10.2.4.11. stainless steel, anodized aluminum, brass, bronze and other metals.

1.10.2.4.12. the Place of the Work outside building envelope: remove debris, rake sod, sweep sidewalks and pavement.

1.10.2.5. Use experienced cleaners or professional cleaners for final cleaning. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

1.10.2.6. Final cleaning includes, without limitation, requirements specified herein, removal of surplus materials, tools, construction machinery and equipment from Site. Carry out final cleaning in accordance with manufacturer's instructions for each material. Clean the Work in accordance with applicable Specification sections and/or manufacturer's directions.

1.10.2.7. Remove stains, spots, marks, dust, smudges caused by Work within Work areas of this Contract. Vacuum, clean and buff resilient flooring.

1.10.2.8. Clean and polish interior glass, windows, entrances, skylights, mirrors, hardware, wall tile, stainless steel, chrome, porcelain, baked enamel, plastic laminate, mechanical, plumbing fixtures and electrical fixtures.

1.10.2.9. Vacuum clean and dust building interiors, behind grilles, louvres and screens. Vacuum clean ducts, fans, blowers and coils if units were operated without filters during construction.

1.10.2.10. Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

1.10.2.11. Broom clean and wash interior as well as exterior walks, paved surfaces, concrete floors, steps and other similar surfaces.

1.10.2.12. Replace broken, damaged, disfigured or scratched glass and mirrors, which are part of Work.

1.10.2.13. Make Good any damage caused outside Work area. Includes doing necessary cleaning required due to Work.

1.10.2.14. Use appropriate apparatus and cleaning materials.

1.10.2.15. Close rooms and areas finished by cleaners, painters and decorators to all but authorized persons.

1.10.2.16. Upon completion of final cleaning, remove cleaning equipment, excess materials and debris from building and Site.

1.12. PROTECTING INSTALLED CONSTRUCTION

1.12.1. Protection of the Work during Construction:

1.12.1.1. Provide continuous protection to public, the Work, the Owner's property and adjacent property during construction. Protect Work of other trades from damage while performing subsequent Work.

1.12.1.2. Protect finished flooring from damage. Make special efforts and take measures when moving heavy loads or equipment over them. Keep floors free of oils, grime, grease or other materials likely to discolour them or affect bond of applied surfaces.

1.12.1.3. Protect, relocate and maintain existing, active services wherever they are encountered. Wherever inactive services are encountered, cap them off and remove unwanted portion, with approval of authorities having jurisdiction or public utility concerned in manner approved by them.

1.12.1.4. Adequately protect floors and roofs from damage. Take special measures when moving heavy loads or equipment on them.

1.12.1.5. Keep floors free of oils, grease or other materials likely to discolour them or affect bond of applied surfaces including fumes generated by temporary heating devices. Take care not to spill or allow oil, grease, gasoline, diesel and fuel oil, chemicals and other substances to contaminate soil or water on or adjacent to Site. Should such contamination accidentally occur report it immediately and clean up to satisfaction of the Consultant.

1.12.1.6. Protect Work of other sections from damage resulting from Work.

1.12.1.7. Damaged Work shall be made good at the Contractor's expense.

1.12.1.8. Protect glass and other finishes against heat, slag and weld splatter using suitable protective shields or covers.

1.12.1.9. Provide and maintain in working order, suitable Underwriters' labelled fire extinguishers and locate in suitable positions, to approval of Authorities Having Jurisdiction.

1.12.1.10. Provide minimum of 3 safety helmets for the Consultant and any other authorized visitors to Site, if required.

1.12.1.11. Protect public and those employed on the Work from injury. Equipment (mobile) when not in use shall have keys removed and locked up in secure location.

1.12.2. Correction after Completion: In conformance with General Conditions of the Contract, Make Good any defects and deficiencies due to faulty materials or quality of performance that become apparent in the Work within 24 months from the date specified in Article A-6 of the Agreement between Owner and Contractor or for such longer period as specified for certain Products in the Contract Documents. Conform to requirements of the General Conditions of the Contract and provide Warranty for 24 months period and for extended period where applicable, in writing in an approved form acceptable to the Consultant signed

by authorized official of the Contractor.

1.13. CLOSEOUT PROCEDURES

1.13.1. Final Site Review: the Consultant will perform final inspection in accordance with provisions under final Certificate for Payment. Conform to the *Construction Act*, R.S.O. 1990, c. C.30for commencement, procedure and release of hold back fund. Lien Period commencement, procedure and release of hold back monies will be in accordance with the *Construction Act*, R.S.O. 1990, c. C.30.

1.13.2. Takeover Procedure:

1.13.2.1. Conform to requirements of following the General Conditions of Contract for take-over procedure:

1.13.2.1.1. Comply also with recommended takeover procedures contained in OAA/OGCA Document No. 100, except as modified by the Contract Documents. In case of conflict with the Contract Documents conform to more stringent requirements. Procedure described consists of following stages:

1.13.2.1.1.1. Stage 1 Contractor's Inspection for Substantial Performance

1.13.2.1.1.2. Stage 2 Contractor's Application for Certificate of Substantial Performance

1.13.2.1.1.3. Stage 3 Consultant's Certificate of Substantial Performance

1.13.2.1.1.4. Stage 4 Consultant's Certificate for Payment of Holdback Monies

1.13.2.1.1.5. Stage 5 Final Inspection for Completion of the Contract

1.13.2.1.1.6. Stage 6 Warranty Period(s)

1.13.2.2. All stages will be reviewed at first Coordination Site Meeting to ensure all parties understand their responsibilities.

1.13.3. Substantial Performance Review: Provide a written request to the Consultant for Substantial Performance review of the Work. Such request shall include a reconciliation of compliance with money test given in Clause 2 (1) (b) of the *Construction Act*, R.S.O. 1990, c. C.30 in addition to all documentation specified in the Contract Documents.

1.13.4. Certification of Substantial Performance: Certificate of Substantial Performance will be prepared by the Owner and provided to the Contractor for publication. The Contractor must comply with the requirements for application for Substantial Performance included in the General Conditions and Supplementary Conditions of the Contract.

1.13.5. Defect and Deficiency:

1.13.5.1. A defect is an item of the Work required by the Contract which has been installed but requires repair and/or replacement at a specific time.

1.13.5.2. A deficiency is an item of the Work required by the Contract which has not been installed or put into operating condition.

1.13.5.3. A warranty item is an item of the Work, installed under the Contract which manufacturer or installer agrees to maintain in, or restore to perfect condition for a specific period of time, after the Owner's acceptance of the Work as being substantially completed.

1.13.5.4. When, in the Consultant's opinion, the Work under the Contract is substantially complete and prior to final inspection by the Owner, a preliminary inspection shall be made at which time all defects and deficiencies shall be listed, taking care to distinguish between the two.

1.13.6. Deficiency Inspection:

1.13.6.1. Provide a written request to the Consultant for deficiency inspection of the Work. Such request shall include a statement by the Contractor that the Work to be reviewed by the Consultant for deficiencies is, to best of his knowledge, in compliance with the Contract Documents, reviewed Shop Drawings, samples and that all previously instructed corrections by the Consultant have been corrected.

1.13.6.2. Provide a schedule of planned deficiency inspections having regard to foregoing.

1.13.7. Deficiency Lists:

1.13.7.1. Neither the Owner's representatives, nor the Consultant will be responsible for issue of extensive lists of deficiencies. The Contractor assumes prime responsibility for ensuring items shown on the Drawings and described in the Specifications are completed. Any inspections to approve Certificates of Substantial Performance will be immediately canceled if it becomes obvious that extensive deficiencies are outstanding.

1.13.7.2. Promptly correct deficiencies noted by the Consultant. Do not proceed with installation of subsequent parts of the Work until deficiencies have been corrected. Every effort shall be made to ensure both defects and deficiencies are Made Good prior to final inspection.

1.13.7.3. Make Good deficiencies before the Contract is considered complete.

1.13.8. Notification of Correction of Deficiencies: Advise Consultant in writing, upon completion of rectification of deficiencies noted by the Consultant. Failure to provide such notification may be cause to withhold final payment.

1.13.9. Documents:

1.13.9.1. Within 21 Days of commencement of the Work, the Contractor shall make first submittal required by OAA/OGCA Document 100, Take-Over Procedures.

1.13.9.2. Submit documents in accordance with requirements of the Contract Documents.

1.13.9.3. Submit required documents along with request for certification of Substantial Performance of the Contract. Consultant's inspection for Substantial Performance of the Contract is not required until such submittal is received.

1.13.10. Final Inspection for Final Payment:

1.13.10.1. Final review of the Work shall constitute inspection precedent to issuance of final certificate of payment.

1.13.10.2. If there are any further deficiencies determined by this review, they shall be listed by the Consultant and provided to the Contractor. This list shall be recognized as final deficiency list for purposes of acceptance of Work under the Contract.

1.13.10.3. Such deficiencies shall be corrected by a date mutually agreed upon between the Consultant and the Contractor, unless a specific date is required by Contract and a re-inspection by Consultant shall be called for by the Contractor following his own inspection to take place within 7 Days from date of request.

1.13.10.4. The Contractor shall thereafter submit its invoice for final payment.

1.13.11. End of Warranty Period Inspection:

1.13.11.1. At beginning of the 24th month from the date specified in Article A-6 of the Agreement between Owner and Contractor and GC 37 of the General Conditions of the Contract the Owner, the Contractor and the Consultant, along with key Subcontractors as designated by the Consultant, carry out a complete inspection of

building and its systems to determine which deficiencies are to be rectified under warranty.

1.13.11.2. Prior to completion of warranty period, arrange with the Consultant to carry out complete review of defects and deficiencies which have been observed during warranty period to determine which are to be corrected.

1.14. CLOSEOUT SUBMITTALS

1.14.1. Certificate of Substantial Performance:

1.14.1.1. Certificate of Substantial Performance will be prepared by the Owner and provided to the Contractor for publication. The Contractor must comply with the requirements for application for Substantial Performance included in the General Conditions and Supplementary Conditions of the Contract.

1.14.2. n/a

1.14.3. Pre-Start Health and Safety Review Reports (PSR): Submit all exemption documents or PSR reports prior to Substantial Performance of the Work in accordance with Section 01 40 00 – Quality Requirements.

1.14.4. Product Record Documents:

1.14.4.1. Obtain from the Consultant and pay the cost for 1 copy of the Specifications and 1 set of white prints of the Contract Drawings at commencement of the Work and 10 Days prior to date of Substantial Performance of the Work; Submit “as-built” Site set of white prints and the Specifications;

1.14.4.2. As Work progresses, clearly mark in a neat and legible form on Specifications and white prints significant changes and deviations from Contract Drawings and Specifications caused by Site conditions, additional instructions and Change Orders. Changes and deviations marked on as-built record Drawings and the Specifications by reference to other documents are not acceptable.

1.14.4.3. Have items relating to mechanical and electrical Work recorded by respective Subcontractor.

1.14.4.4. Print lettering and numbers in size to match original. Lines may be drawn free hand provided they are neat and accurate. Add "AS-BUILT RECORD" at each Drawing title block and on title page of the Specifications.

1.14.4.5. Record following changes and deviations on record Drawings:

1.14.4.5.1. depths of various elements of foundation in relationship to first floor level.

1.14.4.5.2. field changes of dimensions.

1.14.4.5.3. other significant deviations and changes which are concealed in construction and cannot be identified by visual inspection.

1.14.4.5.4. show actual locations of following on record Drawings:

1.14.4.5.4.1. access doors and panels.

1.14.4.5.4.2. inverts of services at key points within building, at points where entering and leaving building, and at property lines. Dimension services in relation to structure and building grid lines.

1.14.4.5.4.3. duct work, piping, conduit, mechanical and electrical equipment and associated Work.

1.14.4.5.4.4. concealed piping, conduit, equipment and conveying systems, including such items provided for future use.

1.14.4.5.4.5. record following information on record Specifications:

1.14.4.5.4.5.1. Products, materials and other items selected from those specified.

1.14.4.5.4.5.2. approved substitutions and accepted alternatives.

1.14.4.5.4.5.3. other approved changes and deviations to items specified.

1.14.4.6. Have record Drawing white prints and Specifications available for inspection at all times.

1.14.5. Maintenance Instructions and Data Book: Provide the Consultant with 3 sets of operating and maintenance instructions and data books, 10 Days prior to advising the Consultant that Work is substantially performed which include:

1.14.5.1. Complete listing of Subcontractors' names, addresses and telephone numbers with notation as to which portions of the Contract have been provided by them.

1.14.5.2. Complete listing of materials, Products and equipment including serial numbers, manufacturer's names and sources of supply.

1.14.5.3. Description of each system, with description of each major component of systems.

1.14.5.4. Operation and installation instructions for each assembly, component and system.

1.14.5.5. Complete cleaning and maintenance instructions for each finish, assembly, component and system, including warnings of harmful practices.

1.14.5.6. Lists of spare parts for each assembly, component and system complete with names, addresses and telephone numbers of Suppliers.

1.14.5.7. Operating curves of mechanical and electrical equipment.

1.14.5.8. A lubrication schedule of all equipment.

1.14.5.9. Page-size Valve Tag Schedule and Flow Diagrams.

1.14.5.10. Water treatment procedures and tests.

1.14.5.11. Final balancing reports for mechanical systems.

1.14.5.12. Installation manual or installation instructions for each mechanical, electrical or architectural item, stamped and signed by Subcontractors submitting them.

1.14.5.13. Record Drawings of mechanical, electrical and special installations.

1.14.5.14. Final reviewed Shop Drawings

1.14.5.15. Copies of all warranties, properly executed.

1.14.5.16. Provide books consisting of 3-ring hard cover loose-leaf binders, indexed as to contents and identified on binding edges as "Maintenance Instructions and Data Book, for Contract No.: T-19-349". Ensure binders contain name of the Contractor and date of Substantial Performance of the Work.

1.14.5.17. Organize and label contents into applicable categories of Work, parallel to the Specification sections and provide a Table of Contents.

1.14.5.18. Use consistent terminology in books.

1.14.5.19. Submit maintenance and operation instructions which are manufacturer's latest published editions at date of submission.

1.14.5.20. Should any finish, Product or assembly be injured or damaged by faulty maintenance materials, practices not warned against in maintenance manual or by failure to provide proper maintenance manuals in time, rectify such damage or injury at no additional cost to the Owner.

1.14.6. Distribution System Diagrams: Prior to date of Substantial Performance of the Work, submit framed single line diagrams of electrical distribution systems.

1.15. DEMONSTRATIONS FOR OWNER'S PERSONNEL

1.15.1. Provide qualified technicians to demonstrate operation and/or maintenance of systems to the Owner's staff.

1.16. PRODUCT WARRANTIES

1.16.1. Examine sections of the Specifications to ensure inclusion of warranties specified.

1.16.2. In addition to the requirements of Article A-6 of the Articles of Agreement and GC 37 of the General Conditions, the Contractor shall not extended warranty periods required by the Contract Documents for certain Products, systems and assemblies as specified under their respective sections.

1.16.3. Typical clause: Similar clause applies to trades listed herein as applicable:

"**WARRANTY**: Warrant the work of aluminum windows against defects and deficiencies in accordance with the General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to failure of system to remain completely weather tight, leaking in excess of specified tolerances and limits, deformation of members, failure of insulated glass units, glass breakage, condensation in excess of specified tolerances and limits, mechanical failure and discolouration of finishes."

1.16.4. Spare Parts:

1.16.4.1. Supply extra maintenance materials and/or spare parts and store in a locked room as directed by the Owner.

Extra Materials to be Submitted by the Contractor	
Material/Equipment	Quantity
Carpet Tiles	20 boxes (un-used)
Resilient Flooring	10 new tiles
Rubber Base	500 linear feet
Ceramic Tile used at back splash in the kitchen	20 extra tiles
Paint: • Main wall colour (white) • Accent Colour • Ceiling Paint	 4 gallons (not opened) 2 gallons (not opened) 2 gallons (not opened)
Light Bulbs • LED tubes • LED Dimmable • LED Bulbs for pot lights	 Ten (10) Ten (10) Five (5)
Ceiling Tiles	50 new ceiling tiles (un-cut)

1.16.4.2. Suitably package maintenance materials in accordance with manufacturer's instructions and label to identify Product type, manufacturer, Product name, colour number, dye lot and quantity.

1.16.4.3. Store maintenance materials, e.g., positioning, proper side up, etc., in accordance with manufacturer's recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 **RELATED DOCUMENTS**

.1 The Drawings and general provisions of the Contract, including General and Supplementary and Division 1 Specification Sections, apply to this Section.

1.2 **SUMMARY**

.1 This Section includes administrative and procedural requirements for the following:

1. Recycling non-hazardous construction waste.
2. Disposing of non-hazardous construction waste.

1.3 **DEFINITIONS**

.1 Construction Waste: Building and Site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes

.2 Demolition Waste: Building and Site improvement materials resulting from demolition or selective demolition operations.

.3 Disposal: Removal off-Site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to Authorities Having Jurisdiction.

.4 Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

.5 Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

.6 Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 **PERFORMANCE REQUIREMENTS**

.1 General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of

.1 Construction Waste(including but not limited to):

.1 Concrete.
.2 Concrete reinforcing steel.
.3 Structural and miscellaneous steel.
.4 Glazing.
.5 Acoustical tile and panels.
.6 Supports and hangers.
.7 Wood Sheet Materials
.8 Rubber base
.9 Lumber.
.10 Metals.

.11 Insulation.

.12 Carpet and pad.

.13 Gypsum board.

.2 Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

.1 Paper.

.2 Cardboard.

.3 Boxes.

.4 Plastic sheet and film.

.5 Polystyrene packaging.

.6 Wood crates.

.7 Plastic pails.

1.5 **SUBMITTALS**

.1 Waste Management Plan: Submit 3 copies of plan within 7 Working Days of receipt of Notice to Commence the Work.

.2 Waste Reduction Progress Reports: Reports are sent weekly tracking the volume sent out. Submit three copies of report. Include the following information:

.1 Generation point of waste.

.2 Total quantity of waste by volume.

.3 Quantity of waste salvaged, both estimated and actual in cubic meters.

.4 Quantity of waste recycled, both estimated and actual in cubic meters.

.5 Total quantity of waste recovered in cubic meters.

.6 Total quantity of waste recovered as a percentage of total waste.

.7 Waste Reduction Calculations: Before request for Substantial Performance of the Contract, submit three copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

.8 Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

.9 Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

.10 Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, volume receipts, and invoices.

.11 Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, volume tickets, receipts, and invoices.

1.6 **QUALITY ASSURANCE**

.1 Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification

.2 Regulatory Requirements: Comply with hauling and disposal regulations of Authorities Having Jurisdiction.

.3 Waste Management Conference: Conduct conference at the Site to comply with requirements related to waste management including, but not limited to, the following:

.1 Review and discuss waste management plan.

.2 Review requirements for documenting quantities of each type of waste and its disposition.

.3 Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.

.4 Review procedures for periodic waste collection and transportation to recycling and disposal facilities.

.5 Review waste management requirements for each trade.

1.7 **WASTE MANAGEMENT PLAN**

.1 General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by volume, but use same units of measure throughout waste management plan.

.2 Waste Identification: Indicate anticipated types and quantities of construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

.3 Waste Reduction Work Plan: List whether each load of waste will be recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

.1 Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.

.2 Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

.3 Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on project Site where materials separation will be located.

.4 Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:

.1 Total quantity of waste.

.2 Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.

.3 Total cost of disposal (with no waste management).

.4 Revenue from recycled materials.

.5 Savings in hauling and tipping fees by donating materials.

.6 Savings in hauling and tipping fees that are avoided.

.7 Handling and transportation costs. Include cost of collection containers for each type of waste.

.8 Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.4 **RECYCLING CONSTRUCTION WASTE**

.1 Packaging:

.1 Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.

.2 Polystyrene Packaging: Separate and bag materials.

.3 Pallets: As much as possible, require deliveries using pallets to remove pallets from project Site. For pallets that remain on-Site, break down pallets into component wood pieces and comply with requirements for recycling wood.

.4 Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

.2 Wood Materials:

.1 Clean Cut-Offs of Lumber: Grind or chip into small pieces.

.2 Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

3.5 **DISPOSAL OF WASTE**

.1 General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from project Site and legally dispose of them in a landfill or incinerator acceptable to Authorities Having Jurisdiction.

.1 Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-Site.

.2 Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

.2 Burning: Do not burn waste materials.

.3 Disposal: Transport waste materials and dispose of at designated spoil areas on the Owner's property.

.4 Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION

PART 1 – GENERAL

1.1 Applicable Standards

.1 2015 ASHRAE Handbook – HVAC Applications Chapter 43 HVAC Commissioning

.2 ASHRAE Guideline 1.1 – 2007 – The HVAC&R Technical Requirements for the Commissioning Process

.3 CSA Z320-11 (R2016) Building Commissioning Standard & Check Sheets

1.2 Description

.1 Commissioning is a systematic process of ensuring that all building systems perform interactively according to the requirements of the Contract Documents and the Region's operational needs. The commissioning process begins in the design phase and continues through construction, acceptance and the warranty period. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, functional testing and training.

.2 Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

.1 Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and industry best practices, and that they receive adequate operational checkout by installing Subcontractors;

.2 Verify and document proper performance of equipment and systems;

.3 Verify that Operations and Maintenance documentation left on Site is complete; and

.4 Verify that the Region's operating personnel are adequately trained.

.3 The commissioning process does not take away from or reduce the responsibility of the system designers or the Contractor to provide a finished and fully functioning product.

1.3 Abbreviations

.1 The following are common abbreviations used in the Commissioning Specifications and in the Commissioning Plan. Definitions are found in Section 1.8.

A/E-	Architect and Design Engineers (the "Consultant")	FT-	Functional performance test
CA-	Commissioning Authority	GC-	General Contractor, including its project manager (the 'Contractor")
CC	Controls Subcontractor	MC-	Mechanical Subcontractor
		PC-	Pre-functional checklists
Cx-	Commissioning	Subs-	Subcontractors to GC
Cx Plan-	Commissioning Plan document	TAB-	Test and Balance Subcontractor
EC-	Electrical Subcontractor	FM	Facility Management
DDC-	Direct Digital Control	EMS-	Energy Management System

1.4 COORDINATION

.1 Commissioning Team. The commissioning team consists of the representatives from the Region, the Facility Management (FM) Staff, Commissioning Authority (CA), the General Contractor (GC or Contractor), the Architect and Design Engineers (A/E) (the "Consultant"), the mechanical Subcontractor (MC), the Electrical Subcontractor (EC), the Testing and Balancing (TAB) Subcontractor, the Controls Subcontractor (CC), any other installing subcontractors or suppliers of equipment.

.2 Management. The CA is hired by the Region and follows the rules of an Independent Commissioning Authority. The CA directs and coordinates the commissioning activities and reports to the Region. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

.3 Scheduling. The CA will work with the Region and GC to schedule the commissioning activities. The CA will provide sufficient notice to the Region and GC for scheduling commissioning activities. The GC shall integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process. The CA will work with the GC to provide the initial schedule of primary commissioning events at the commissioning scoping meeting. The Commissioning Plan provides a format for this schedule. As construction progresses more detailed schedules are developed by the GC and the CA. The Commissioning Plan also provides a format for detailed schedules.

1.5 COMMISSIONING PROCESS

.1 Commissioning Plan. The commissioning plan provides guidance in the execution of the commissioning process. Following the commissioning scoping meeting, the CA will update the plan which is then considered the "final" plan, though it will continue to evolve and expand as the project progresses. The Specifications will take precedence over the Commissioning Plan.

.2 Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

.1 Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.

.2 Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.

.3 Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures and Shop Drawings.

.4 The CA works with the Subs in developing startup plans and startup documentation formats, including providing the Subs with pre-functional test sheets to be completed during the startup process.

.5 In general, the checkout and performance verification proceeds from simple to complex; from component level, to equipment, to systems, and finally intersystem levels with pre-functional test sheets being completed before functional testing.

.6 The Subs, under their own direction, execute and document the pre-functional test sheets and perform startup and initial checkout. The CA documents that the test sheets and startup were completed according to the approved plans. This may include the CA witnessing start-up of selected equipment.

.7 The CA develops specific equipment and system functional performance test procedures with the assistance of Subs as required. The Subs review the test procedures once prepared.

.8 The procedures are executed by the Subs, under the supervision of, and documented by the CA.

.9 Items of non-compliance in material, installation or setup are corrected at the Sub's expense and the system retested.

.10 The CA reviews the O&M documentation for completeness.

.11 Commissioning is completed before Substantial Performance of the Contract.

.12 Deferred testing is conducted, as specified or required.

1.6 RELATED WORK

.1 Specific commissioning requirements are given in the following Sections of these Specifications. All of the following sections apply to the Work of this Section.

01 91 00	*Commissioning*	*Describes the commissioning process, responsibilities common to all parties, responsibilities of the Consultant, CA, GC and Suppliers, focusing on the CA. The unique MC, CC, TAB and EC (including the Subcontractors for the Special Systems) responsibilities are included in Divisions 21, 22, 23, 25, 26, and 28.*
21 08 00 *22 08 00* *23 08 00* *25 08 00*	*Fire Suppresion System Cx* *Plumbing Cx* *HVAC Cx* *Integrated Automation Cx*	*Describes the Cx responsibilities of the Fire Protection, Plumbing, Mechanical, TAB and Controls Contractors and the pre-functional testing and startup responsibilities of each. Points to 01 91 00 for functional testing requirements and provides the pre-functional and the specific functional testing requirements for Division 21, 22, 23 and 25 equipment, for use on this project.*
26 08 00	*Electrical Cx*	*Describes the specific Cx responsibilities of the Division 26 Subcontractor.*

1.7 RESPONSIBILITIES

.1 General: General Commissioning Responsibilities are as follows:

.1 The responsibilities of various parties in the commissioning process are provided in this Section. The responsibilities of the mechanical Subcontractor and TAB are in Division 23 and controls Subcontractor are in Division 25; those of the electrical Subcontractor in Division 26, and Electronic Safety and Security in Division 28. It is noted that the services for the Region the Consultant including HVAC, Mechanical, and Electrical Designers/Engineers, are not provided for in this Section. That is, the Contractor is not responsible for providing services covered under these parties scope; their responsibilities are listed here to clarify the commissioning process.

.2 All Parties: Commissioning responsibilities for all parties are as follows:

.1 Attend commissioning scoping meeting and additional meetings, as necessary.

.3 Architect (of the Consultant): Commissioning responsibilities of the Architect are as follows:

.1 Attend the commissioning scoping meeting and selected commissioning team meetings.

.2 Perform normal submittal review, construction observation, As-Built Drawing preparation, O &M manual preparation, etc., as contracted.

.3 Provide any design narrative documentation requested by the CA.

.4 Coordinate resolution of system deficiencies identified during commissioning, according to the Contract Documents.

.5 Prepare and submit final as-built design intent documentation for inclusion in the O&M manuals. Review the O&M manuals.

.6 Coordinate resolution of design non-conformance and design deficiencies identified during warranty-period commissioning.

.4 Mechanical and Electrical Designers/Engineers (of the Consultant): Commissioning responsibilities of the Mechanical and Electrical Engineers are as follows:

.1 Perform normal submittal review, construction observation, As-Built Drawing preparation, etc., as contracted. One Site observation should be completed just prior to system startup.

.2 Provide any design narrative and sequences documentation requested by the CA. The Designers shall assist (along with the GC and/or Subcontractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

.3 Attend commissioning scoping meetings and other selected commissioning team meetings.

.4 Participate in the resolution of system deficiencies identified during commissioning, according to the Contract Documents.

.5 Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review the O&M manuals.

.6 From the Contractor's red-line drawings, edit and update one-line diagrams developed as part of the design narrative documentation and those provided by the vendor as Shop Drawings for the chilled and hot water, condenser water, domestic water, steam and condensate systems; supply, return and exhaust air systems and emergency power system.

.7 Provide a presentation at one of the training sessions for the Region's personnel.

.8 Witness testing of selected pieces of equipment and systems.

.9 Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.

.5 Commissioning Authority (CA): Commissioning Responsibilities of the Commissioning Authority are as follows:

.1 The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the General Contractor and the Consultant. The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The GC and/or Subcontractors will provide all tools or the use of tools to start, check-out and functionally test equipment and systems, except for specified testing with portable data-loggers, which shall be supplied and installed by the CA.

.2 Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

.3 Coordinate the commissioning work and, with the GC ensure that commissioning activities are being scheduled into the master schedule.

.4 Develop and issue the Commissioning Plan.

.5 Plan and conduct a commissioning scoping meeting and other commissioning meetings.

.6 Before startup, review the current control sequences and interlocks and work with the GC and Subcontractors and Design Engineers until sufficient clarity has been obtained, in writing, to be able to write detailed functional testing procedures.

.7 Review submittals provided by the GC and Subcontractors applicable to systems being commissioned for compliance with commissioning needs, concurrent with the Consultant reviews. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.

.8 Write and distribute pre-functional tests and test sheets.

.9 Develop an enhanced start-up and initial systems checkout plan with Subs.

.10 Perform Site visits, as necessary, to observe component and system installations. Attend selected planning and Site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.

.11 Witness all or part of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Notify the Region of any deficiencies in results or procedures.

.12 Witness all or part of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Notify the Region of any deficiencies in results or procedures.

.13 Approve pre-functional tests and checklist completion by reviewing pre-functional checklist reports and by selected Site observation and spot checking.

.14 Approve systems start-up by reviewing start-up reports and by selected Site observation.

.15 Review TAB execution plan.

.16 Oversee sufficient functional testing of the control system and approve it to be used for TAB, before TAB is executed.

.17 Review air and water systems balancing by spot testing, by reviewing completed reports, and by selected Site observation.

.18 With necessary assistance and review from installing Subcontractors, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone data-logger monitoring, or manual functional testing.

.19 Analyze any functional performance trend logs and monitoring data to verify performance.

.20 Coordinate, witness and approve manual functional performance tests performed by installing Subcontractors. Coordinate retesting as necessary until satisfactory performance is achieved. Perform actual functional testing with contractors on equipment so specified in Section 01 91 00 sub-section 1.9.

.21 Maintain a master deficiency and resolution log and a separate testing record. Provide the Region with written progress reports and test results with recommended actions.

.22 Witness performance testing of smoke control systems by others and all other Region contracted tests or tests by manufacturer's personnel over which the CA may not have direct control. Document these tests and include this documentation in Commissioning Binders.

.23 Review equipment warranties to ensure that the Region's responsibilities are clearly defined.

.24 Oversee and approve the training of the Region's operating personnel. Compile and maintain a commissioning record book(s).

.25 Review the preparation of the O&M manuals. Provide a final commissioning report (as described in this Section).

.26 Develop a Systems Operating Manual.

.27 Coordinate and supervise required seasonal or deferred testing and deficiency corrections.

.28 Return to the Site at 20 months into the 24 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

.6 Contractor/Project Manager (PM): Commissioning Responsibilities of the Contractor/Project Manager are as follows:

.1 Facilitate the coordination of the commissioning work by the CA, and ensure that commissioning activities are being scheduled into the master schedule.

.2 Review the final Commissioning Plan.

.3 Attend a commissioning scoping meeting and other commissioning team meetings.

.4 Include the cost of commissioning in the total Contract Price submitted in the Contractor's bid.

.5 Perform the normal review of the Contractor's submittals.

.6 Furnish a copy of all construction documents, addenda, change orders and approved submittals and Shop Drawings related to commissioned equipment to the CA.

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

.8 Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.

.9 Observe and witness pre-functional test sheets, startup and functional testing.

.10 Review commissioning progress and deficiency reports.

.11 Coordinate the resolution of non-compliance and design deficiencies identified in all phases of commissioning.

.12 Sign-off on individual commissioning tests as completed and passing.

.13 Coordinate the training of Region personnel.

.14 Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the Final Commissioning Program.

.15 Assist the CA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

.16 Ensure that Subs execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.

.17 Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and As-Built Drawings for applicable issues identified in any seasonal testing.

.7 Equipment Suppliers: Commissioning Responsibilities of the Equipment Suppliers are as follows:

.1 Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Region to keep warranties in force.

.2 Assist in equipment testing per agreements with Subs, which may include factory tests and the development of associated reports.

.3 All costs associated with provision of all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents shall be included in the total Contract Price submitted in the Contractor's bid, except for stand-alone data-logging equipment that may be used by the CA.

.4 Through the Contractors to which products are supplied, analyze specified products and verify that the Consultant has specified the newest most updated equipment reasonable for this project's scope and budget.

.5 Provide information requested by CA regarding equipment sequence of operation and testing procedures.

.6 Review test procedures for equipment installed by factory representatives.

1.8 DEFINITIONS

The following definitions apply to this Section in addition to the defined term included in the Definitions Section of the Contract:

.1 Approval - acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.

.2 Basis of Design - The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. The basis of design is the technical response to the design intent.

.3 Commissioning Authority (CA) – The CA works independent of the design and constructions teams. The CA directs and coordinates the day-to-day commissioning activities. The CA does not take an oversight role like the Contractor. The CA is part of the Region's project team or shall report directly to the Region.

.4 Commissioning Plan - an overall plan that provides the structure, schedule and coordination planning for the commissioning process.

.5 Control system - the central building energy management control system.

.6 Direct Digital Control (DDC) – Automated building control utilizing analog or digital signals to building controllers, actuators, valves, sensors, and other HVAC control related components

.7 Data-logging - monitoring flows, currents, status, pressures, etc. of equipment using stand-alone data-loggers separate from the control system.

.8 Deferred Functional Tests – FT's that are performed later, after achieving Substantial Performance of the Contract, due to partial occupancy, equipment, seasonal requirements, design or other Site conditions that disallow the test from being performed.

.9 Deficiency - a condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not compliant with the design intent).

.10 Design Narrative or Design Documentation - sections of either the Design Intent or Basis of Design.

.11 Energy Management System (EMS) – an integrated software system that collects, logs and displays data from sources of energy use

.12 Factory Testing - testing of equipment on Site or at the factory by factory personnel with a Region representative present.

.13 Functional Test (FT) - test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB Subcontractor's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The Commissioning Authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing Subcontractor or vendor. FTs are performed after pre-functional test sheets and startup are complete.

.14 Manual Test - using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

.15 Monitoring - the recording of parameters (flow, current, status, pressure, etc.) of equipment operation using data-loggers or the trending capabilities of control systems.

.16 Non-Compliance - see Deficiency.

.17 Non-Conformance - see Deficiency.

.18 Over-written Value - writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75F to verify economizer operation). See also "Simulated Signal."

.19 Region-Contracted Tests - tests paid for by the Region outside the GC's Contract and for which the CA does not oversee. These tests will not be repeated during functional tests if properly documented.

.20 Phased Commissioning - commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.

.21 Pre-functional Checklist (PC) - a list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CA to the Sub. Pre-functional test sheets are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels satisfactory, labels affixed, gages in place, sensors calibrated, etc.). However, some pre-functional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). Pre-functional refers to before functional testing and shall be completed by the installing Subcontractor. Pre-functional test sheets augment and are combined with the manufacturer's start-up checklist. The CA may choose to witness pre-functional tests for large/critical pieces of equipment.

.22 Project Manager (PM) - the General Contractor's representative in the day-to-day activities of construction.

.23 Sampling - functionally testing only a fraction of the total number of identical or near identical pieces of equipment. Refer to Section 01 91 00, Part 3.5.9.8 for details.

.24 Seasonal Performance Tests - FT's that are deferred until the system(s) will experience conditions closer to their design conditions.

.25 Simulated Condition - condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).

.26 Simulated Signal - disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and Direct Digital Control (DDC) system to simulate a sensor value.

.27 Startup - the initial starting or activating of dynamic equipment, including executing pre-functional test sheets.

.28 Test Procedures - the step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CA.

.29 Test Requirements - requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the Contract Documents (Sections 25 08 00 and 26 08 00)

.30 Trending - monitoring using the building control system.

.31 Vendor - supplier of equipment.

.32 Warranty Period - warranty period for entire project as set out in Article A-6 of the Articles of Agreement and GC 37 of the General Conditions, including equipment components.

1.9 SYSTEMS TO BE COMMISSIONED

.1 Systems to be commissioned have been detailed below:

- .1 Building Automation System – For Equipment/Systems in scope of work only
- .2 Fan Coil Units
- .3 Valves
- .4 Air Handling Units
- .5 Humidifiers
- .6 Lighting and Lighting Controls

PART 2- PRODUCTS

2.1 Test Equipment

.1 The Contractor shall ensure that all standard testing equipment required to perform startup and initial checkout and required functional performance testing be provided by the GC or Division Subcontractor for the equipment being tested. For example, the HVAC Subcontractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC system and controls systems except for equipment specific to and used by TAB in their commissioning responsibilities.

.2 All costs associated with the special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the total Contract Price submitted by the Contractor in its Bid, except for stand-alone datalogging equipment that may be used by the CA.

.3 Data-logging equipment and software required to test equipment will be provided by the CA, but shall not become the property of the Region.

.4 All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. Temperature sensors and digital thermometers shall have a certified calibration within the past year to accuracy of 0.28°C (0.5°F) and a resolution of ± 0.056°C (0.1°F). Pressure sensors shall have an accuracy of ± 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3- EXECUTION

3.1 Meetings

.1 The CA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CA. Information gathered from this meeting will allow the CA to create the Commissioning Plan to its "final" version, which will also be distributed to all parties.

.2 Miscellaneous Meetings. Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CA will plan these meetings and will minimize unnecessary time being spent by Subs.

3.2 Reporting

.1 The CA will provide regular reports to the Contractor and the Region, depending on the management structure, with increasing frequency as construction and commissioning progresses. Standard forms are provided and referenced in the Commissioning Plan.

.2 The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

.3 Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

.4 A final summary report developed by the CA will be provided to the Contractor and the Region, focusing on evaluating commissioning process issues and identifying areas where the process could be improved. Pre-functional test sheets and functional tests will not be part of the final report.

3.3 Submittals

.1 The Contractor and its Subcontractors shall provide the CA standard submittals required to facilitate the commissioning work. This process will be integrated into the normal submittal process and protocol of the construction team. At a minimum, the submittals will include equipment Shop Drawings, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings, and details of Region contracted tests. In addition, the installation and checkout materials that are shipped inside the equipment and the field checkout forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority. The Contractor shall ensure that all documentation requested by the CA is included by the Subs in their O&M manual contributions.

.2 The Commissioning Authority will review submittals related to the commissioned equipment for conformance to Region's project requirements as they relate to the commissioning process.

.3 The CA may request additional design narrative from the Consultant and controls Subcontractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

.4 These submittals to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CA will review them.

3.4 Start-up, Pre-Functional Test Sheets and Initial Checkout

.1 The following procedures apply to all equipment to be commissioned. Some systems that are not comprised so much of actual dynamic machinery (e.g. electrical system power quality) may have very simplified PCs and startup.

.1 General. Pre-functional test sheets are a critical commissioning piece in order to ensure functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full pre-functional checkout. No sampling strategies are used. The pre-functional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

.2 Start-up and Initial Checkout Plan. The CA shall assist the commissioning team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for pre-functional test sheets and startup are identified in the commissioning scoping meeting and in the checklist forms. The parties responsible for executing functioning performance testing are detailed in specific commissioning specification sections (refer to Section 01 91 00 subsection 1.6 of this document for details).

.3 Pre-functional test scripts are provided by the CA to the Contractor. The Contractor determines which trade is responsible for executing and documenting each of the line item tasks and notes that trade on the form. Each form will have more than one trade responsible for its execution.

.4 The Contractor shall ensure that the Subcontractor responsible for the purchase of the equipment develops the full start-up plan by combining (or adding to) the CA's test sheets with the manufacturer's detailed start-up and checkout procedures from the O&M manual and the normally used field checkout sheets. The plan will include test sheets and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan. The full start-up plan could consist of something as simple as:

.1 The CA's pre-functional test sheets.

.2 The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.

.3 The manufacturer's normally used field checkout sheets.

.5 The Contractor submits the full startup plan to the CA for review.

.6 The CA reviews the procedures and the format for documenting them, noting any procedures that need to be added.

.7 The full start-up procedures and the approval form may be provided to the Contractor for review depending on management protocol.

.2 Sensor and Actuator Calibration:

.1 All field-installed temperature, relative humidity, CO/CO2, and pressure sensors/gauges, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described below. Alternate methods may be used, if accepted by the Region in advance. All test instruments shall have had a certified calibration within the last 12 months. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

.2 All procedures used shall be fully documented on the pre-functional test sheets or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.

.3 Sensor Calibration Methods:

.1 All Sensors verify that all sensor locations are appropriate and away from causes of erratic operation. Verify that sensors with shielded cable are grounded only at one end. For sensor pairs that are used to determine a temperature or pressure difference, make sure they are reading within 0.2°F of each other for temperature and within a tolerance equal to 2% of the reading, of each other, for pressure.

.2 Sensors Without Transmitters--Standard Application. Make a reading with a calibrated test instrument within 6 inches of the Site sensor. Verify that the sensor reading (via the permanent thermostat, gage or Building Automation System (BAS)) is within the tolerances in the table below of the instrument-measured value. If not, install offset in BAS, calibrate or replace sensor.

.3 Sensors With Transmitters--Standard Application. Disconnect sensor. Connect a signal generator in place of sensor. Connect ammeter in series between transmitter and BAS control panel. Using manufacturer's resistance-temperature data, simulate minimum desired temperature. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the BAS. Record all values and recalibrate controller as necessary to conform with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction. Reconnect sensor. Make a reading with a calibrated test instrument within 6 inches of the Site sensor. Verify that the sensor reading (via the permanent thermostat, gage or BAS) is within the tolerances in the table below of the instrument-measured value. If not, replace sensor and repeat. For pressure sensors, perform a similar process with a suitable signal generator.

.4 Tolerances, Standard Applications

Sensor	**Required Tolerance [+/-]**
Cooling coil, chilled and condenser water temps	0.22°C (0.4°F)

Sensor	**Required Tolerance (+/-)**
Flow rates, water	4% of design
Relative humidity	4% of design

AHU wet bulb or dew point	1.11°C (2.0°F)
Hot water coil and boiler water temp	0.83°C (1.5°F)
Outside air, space air, duct air temps	0.22°C (0.4°F)
Watt hour, voltage & amperage	1% of design
Pressures, air, water and gas	3% of design
Flow rates, air	10% of design

Combustion flue temps	2.78°C (5.0°F)
Oxygen or CO_2 monitor	0.1 % pts
CO monitor	0.01 % pts
Natural gas and oil flow rate	1% of design
Steam flow rate	3% of design
Barometric pressure	338.639 Pa (0.1 in. of Hg)

.5 Valve and Damper Stroke Setup and Check:

.1 EMS Readout For all valve and damper actuator positions checked, verify the actual position against the BAS readout. Set pumps or fans to normal operating mode. Command valve or damper closed, visually verify that valve or damper is closed and adjust output zero signal as required. Command valve or damper open, verify position is full open and adjust output signal as required. Command valve or damper to a few intermediate positions. If actual valve or damper position doesn't reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

.2 Closure for heating coil valves (NO): Set heating setpoint 11.11°C (20°F) above room temperature. Observe valve open. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set heating setpoint to 11.11°C (20°F) below room temperature. Observe the valve close. Restore to normal.

.3 Closure for cooling coil valves (NC): Set cooling setpoint 11.11°C (20°F) above room temperature. Observe the valve close. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set cooling setpoint to 11.11°C (20°F) below room temperature. Observe valve open. Restore to normal.

.6 Execution of Pre-functional Test Sheets and Startup:

.1 The Contractor shall ensure that, a minimum of 28 Days prior to startup, the Subs and vendors schedule startup and checkout with the Contractor and CA. The performance of the pre-functional test sheets, startup and checkout are directed and executed by the Sub or vendor. When checking off pre-functional test sheets, signatures may be required of other Subs for verification of completion of their work.

.2 The CA shall observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units, (in which case a sampling strategy may be used as accepted by the PM).

.3 For lower-level components of equipment, (e.g., VAV boxes, sensors, controllers), the CA shall observe a sampling of the pre-functional and start-up procedures.

.4 The Contractor shall ensure that the Subs and vendors execute startup and provide the CA with a signed and dated copy of the completed start-up and pre-functional tests and test sheets.

.5 Only individuals that have direct knowledge and witnessed that a line item task on the pre-functional checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

.7 Deficiencies, Non-Conformance and Approval in Test Sheets and Startup:.

.1 The Contractor shall ensure that the Subs clearly list any outstanding items of the initial start-up and pre-functional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.

.2 The CA reviews the report and submits either a non-compliance report or an approval form to the Region. The CA shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The CA will involve the Contractor and others as necessary. The Contractor shall ensure that the installing Subs or vendors correct all areas that are deficient or incomplete in the test sheets and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CA recommends approval of the execution of the test sheets and startup of each system to the Contractor using a standard form.

3.5 Functional Testing

.1 This sub-section applies to all commissioning functional testing for all divisions.

.2 Systems to be Commissioned: The list of equipment to be commissioned is detailed in specific commissioning specification sections (refer to Section 01 91 00 subsection 1.6 of this document for details).

.3 Objectives and Scope: The objective of functional performance testing is to demonstrate that each system is operating according to the Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

.4 In general, each system should be operated by the Contractor through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response and from the approved Shop Drawings. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

.5 Development of Test Procedures: Before test procedures are written, the CA shall obtain all requested documentation and a current list of Change Orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements in specific commissioning specification sections (refer to Section 01 91 00 subsection 1.6 of this document for details), the CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. The Contractor shall ensure that each Sub or vendor responsible to execute a test provides limited assistance to the CA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection. The CA may submit the tests to the Consultant for review, if requested.

.6 The CA shall review Region-contracted, factory testing or required Region acceptance tests which the CA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the Specifications. Redundancy of testing shall be minimized.

.7 The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.

.8 The test procedure forms developed by the CA shall include (but not be limited to) the following information:

.1 System and equipment or component name(s)

.2 Equipment location and ID number

.3 Date

.4 Project name

.5 Participating parties

.6 A copy of the specification section describing the test requirements

.7 A copy of the specific sequence of operations or other specified parameters being verified

.8 Required pre-test field measurements (filled-up pre-functional tests)

.9 Instructions for setting up the test.

.10 Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format

.11 Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.

.12 A section for comments

.13 Signatures and date block for the CA and all participating parties.

.9 Test Methods:

.1 Test Execution Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone data-loggers. The CA may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the Region. This may require a change order and adjustment in charge to the Region. The CA will determine which method is most appropriate for tests that do not have a method specified.

.2 Simulated Conditions Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.

.3 Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

.4 Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.

.5 Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 55°F, when the outside air temperature is above 55°F, temporarily change the lockout setpoint to be 2°F above the current outside air temperature.

.6 Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during pre-functional testing.

.7 Setup: Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Contractor shall ensure that the Sub executing the test provides all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.

.8 Sampling: Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution.

A common sampling strategy referenced in the Specifications as the “xx% Sampling—yy% Failure Rule” is defined by the following example.

xx = the percent of the group of identical equipment to be included in each sample.

yy = the percent of the sample that if failing, will require another sample to be tested.

The example below describes a 20% Sampling—10% Failure Rule.

.9 Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the “first sample.”

.10 If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample).

.11 If 10% of the units in the second sample fail, test all remaining units in the whole group.

.12 If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification as determined by the CA, the CA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

.10 Coordination and Scheduling:

.1 The Subs shall provide sufficient notice to the CA regarding their completion schedule for the pre-functional test sheets and startup of all equipment and systems. The CA will schedule functional tests through the Contractor and affected Subs. The CA shall direct, witness and document the functional testing of all equipment and systems. The Contractor shall ensure that the Subs execute the tests.

.2 In general, functional testing is conducted after pre-functional testing and startup has been satisfactorily completed. The control system is sufficiently tested and approved by the CA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

.11 Test Equipment.: Refer to Section 01 91 00, Part 2 for test equipment requirements.

.12 Problem Solving: The CA will recommend solutions to problems found, however it is the responsibility of the Subs, and the GC to solve, correct and retest problems.

3.6 Documentation, Non-Conformance and Approval of Tests

.1 Documentation: The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the Contractor and its Subs for review. The CA will include the filled out forms in the Commissioning Binders.

.2 Non-Conformance:

.1 All deficiencies or non-conformance issues shall be noted and reported to the Region on a standard non-compliance form.

.2 Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.

.3 Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues.

.4 As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.

.1 When there is no dispute on the deficiency and the Sub accepts responsibility to correct, the following course of action occurs:

.2 The CA documents the deficiency in deficiency tracking log and issues to the Project Team. The Sub corrects the issue and signs off on the deficiency tracking log indicating the issue has been resolved.

.3 The CA reschedules the test and the test is repeated. If the test is successful, the CA closes the item.

.5 If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

.1 The deficiency shall be documented on the deficiency tracking log with the Sub's response and a copy given to the Contractor and to the Sub representative assumed to be responsible.

.2 Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the Consultant. Final acceptance authority is with the Region.

.3 The CA documents the resolution process.

.4 Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs off on the deficiency tracking log and provides it to the CA. The CA reschedules the test and the test is repeated until satisfactory performance is achieved, at which time the CA closes the item.

.6 Cost of Retesting:

.1 The cost for the Sub to retest a pre-functional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC. The Region shall not be responsible for any costs associated with retesting due to a deficiency caused by the GC or a Subcontractor.

.2 For a deficiency identified, not related to any pre-functional checklist or start-up fault, the following shall apply: The CA and the Contractor will direct the retesting of the equipment once at no “charge” to the GC for their time.

.3 Refer to the sampling section of Section 01 91 00, Part 3.5 for requirements for testing and retesting identical equipment.

.7 The Contractor shall respond in writing to the CA and the Region at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

.8 The CA retains the original deficiency tracking log until the end of the project.

.9 Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

.3 Approval:

.1 The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA and by the Region, if necessary. The CA recommends acceptance of each test to the Region using a standard form. The Region gives final approval on each test using the same form, providing a signed copy to the CA and the Contractor.

3.7 Operation and Maintenance Manuals

.1 The specific content and format requirements for the standard O&M manuals are detailed in Mechanical and Electrical Specifications by the Contractor.

.2 Consultant Contribution: The Consultant will include in the beginning of the O&M manuals a separate section describing the systems including:

.1 The design intent narrative prepared by the Consultant and provided as part of the Contract Documents, updated to as-built status by the Consultant. These documents will be provided to the Contractor at time of Substantial Performance of the Work.

.2 Simplified professionally drawn single line system diagrams on 215.9mm x 279.4mm (8 ½” x 11”) or 279.4mm x 431.8mm (11” x 17”) sheets. These shall include chilled water system water system, heating system, steam system, supply air systems, exhaust systems, domestic hot water and electrical single lines. These shall show major pieces of equipment.

.3 CA Review Prior to Substantial Performance of the Contract, the CA shall review the O&M manuals, documentation and redline as-builts for systems that were commissioned and to verify compliance with the Specifications. The CA will communicate deficiencies in the manuals to the Region or Consultant, as requested. Upon a successful review of the corrections, the CA recommends acceptance of these sections of the O&M manuals to the Region or Consultant. The CA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the Consultant’s review of the O&M manuals.

3.8 Training of Region Personnel

.1 The GC shall be responsible for training coordination and scheduling, and ultimately for ensuring that training is completed.

.2 The CA shall interview the facility manager and Consultant to determine the special needs and areas where training will be most valuable. The Region and CA shall decide how rigorous the training should be for each piece of commissioned equipment. The CA shall communicate the results to the Subs and vendors who have training responsibilities.

.3 In addition to these general requirements, the detailed training requirements of the Region personnel by Subs and vendors is detailed in specific commissioning specification sections (refer to Section 01 91 00 Subsection 1.6 of this document for details).

.4 Each Sub and vendor responsible for training will submit a written training plan to the CA for review and approval prior to training. The plan will cover the following elements:

.1 Equipment (included in training)

.2 Intended audience

.3 Location of training

.4 Objectives

.5 Subjects covered (description, duration of discussion, special methods, etc.)

.6 Duration of training on each subject

.7 Instructor for each subject

.8 Methods (classroom lecture, video, Site walk-through, actual operational demonstrations, written handouts, etc.)

.9 Instructor and qualifications

.5 For the primary HVAC equipment, the controls Subcontractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.

.6 The CA develops an overall training plan and coordinates and schedules, with the Region, the overall training for the commissioned systems. The CA develops criteria for determining that the training was satisfactorily completed, including attending some of the training, etc. The CA recommends approval of the training to the Region using a standard form. The Region will also sign the approval form.

.7 The Mechanical and Electrical Design Engineer shall at the first training session present the overall system design concept and the design concept of each equipment section. This presentation shall include a review of all systems using the simplified system schematics (one-line drawings) including chilled water systems, heating systems, air distribution system, control system strategies, electrical distribution, fire systems, etc.

3.9 Deferred Testing

.1 Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of test sheets and functional testing may be delayed upon approval of the Region. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

.2 Seasonal Testing During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing will be made.

3.10 WRITTEN WORK PRODUCTS

.1 The commissioning process generates a number of written work products described in various parts of the Specifications. The Commissioning Plan lists all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the specification to create them. In summary, the written products are:

	Product	Developed By
1.	Final commissioning plan	CA
2.	Commissioning Meeting Minutes	CA
3.	Commissioning Schedule	CA with GC
4.	Equipment documentation submittals	Subs
5.	Sequence clarifications	Subs and A/E as needed
6.	Pre-functional test sheets	CA
7.	Startup and initial checkout plan	Subs and CA (compilation of existing documents)
8.	Startup and initial checkout forms filled out	Subs
9.	Final TAB report	TAB Subcontractor
10.	Issues log (deficiencies)	CA
11.	Commissioning Progress Record	CA
12.	Functional test forms	CA
13.	Filled out functional tests	CA
14.	O&M manuals	Subs
15.	Final Commissioning Documentation	CA
16.	Overall training plan	CA
17.	Specific training agendas	Subs
18.	Final commissioning report	CA
19.	Misc. approvals	CA

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this section.

1.2. SUMMARY

1.2.1. Section Includes: Provide rough carpentry including but not limited to following:

1.2.1.1. miscellaneous interior carpentry.

1.2.2. Related Sections: The following description of the Work is included for reference only and shall not be presumed complete:

1.2.2.1. Provision of architectural woodwork: Section 06 40 00, Architectural Woodwork.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. CCA: Chromated Copper Arsenate.

1.3.1.2. COFI: Council of Forest Industries; www.cofi.org.

1.3.1.3. FSC: Forest Stewardship Council; www.fsccanada.org.

1.3.1.4. MSDS: Material Safety Data Sheets.

1.3.1.5. NLGA: National Lumber Grades Authority; www.nlga.org.

1.3.1.6. SCAQMD: South Coast Air Quality Management District; www.agmd.gov.

1.3.1.7. ULC: Underwriters' Laboratories of Canada; www.ulc.ca.

1.3.1.8. UL: Underwriters Laboratories Inc.; www.ul.com.

1.3.1.9. VOC: Volatile Organic Compound.

1.3.2. Definitions:

1.3.2.1. Dimension Lumber: Lumber of 50 mm (2") nominal or greater but less than 125 mm (5") nominal in least dimension.

1.3.2.2. Timber: Lumber of 125 mm (5") nominal or greater in least dimension.

1.3.3. Reference Standards:

1.3.3.1.	CSA O80 Series-08	- Wood Preservation
1.3.3.2.	CSA O121-08	- Douglas Fir Plywood
1.3.3.3.	CAN/ULC-S102-07	- Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

1.4. QUALITY ASSURANCE

1.4.1. Certifications:

1.4.1.1. Grading:

1.4.1.1.1. Provide lumber bearing the grading stamps of an agency certified by the Canadian Lumber Standards Administration Board for identification.

1.4.1.1.2. Provide roof sheathing bearing the COFI grading stamp for identification.

1.4.1.1.3. Provide "treated" and "fire treated" wood and plywood bearing the stamp of the Canadian Wood Preservers Bureau.

1.5. DELIVERY, STORAGE AND HANDLING

1.5.1. Storage and Handling Requirements:

1.5.1.1. Store lumber in a dry place and protect from dampness and damage.

1.5.1.2. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1. MATERIALS

2.1.1. Description:

2.1.1.1. Regulatory Requirements: Provide a Pre-Start Health and Safety Review in accordance with the *Occupational Health and Safety Act,* R.S.O. 1990, c. O.1Reg. 851, Industrial Establishments, as amended. Refer to Section 01 40 00 – Quality Requirements for further requirements.

2.1.2. Softwood Lumber: Of grades conforming to NLGA's "Standard Grading Rules for Canadian Lumber", graded as follows:

2.1.2.1. Light Framing: Species Group D, Standard Grade.

2.1.2.2. Studding: Species Group D, Stud Grade.

2.1.2.3. Structural Light Framing: Species Group D, No. 1 Grade.

2.1.2.4. Appearance Lumber: Species Group B, Appearance Grade.

2.1.3. Hardwood Lumber: Of grades conforming to grading rules of U.S. National Hardwood Lumber Association, solid Yellow Birch, select or better.

2.1.4. Concealed Framing Lumber: No. 2 White Pine, No. 2 Red Pine, or No. 1 Construction Eastern Spruce, Balsam Fir or Jack Pine, kiln dried, free from sap, shakes, splits, knots and other defects.

2.1.5. Grounds, Nailing Strips and Blocking: No. 2 White Pine, No. 2 Red Pine, or No. 1 Construction Eastern Spruce, kiln dried, free from sap, shakes, splits, knots and other defects.

2.1.6. Glue: Waterproof.

2.1.7. Rough Hardware: Supply rough hardware to frame and fix rough carpentry. This includes bolts, anchors nails, expansion shields and other fastenings required. Hot dip galvanize hardware for exterior work; elsewhere, provide cadmium plated hardware. Provide spiral thread nails.

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions: Verify the actual Site dimensions and location of adjacent materials prior to commencing the Work. Notify the Consultant in writing of any conditions which would be detrimental to the installation.

3.1.2. Evaluation and Assessment: Commencement of Work implies acceptance of previously completed work.

3.2. INSTALLATION

3.2.1. Properly frame together parts of the Work with members accurately cut to size, closely fitted, well spiked and erected in a substantial manner, plumb, level, square and true to dimension.

3.2.2. Locate joints over bearing or supporting surfaces.

3.2.3. Provide running members full length wherever possible.

3.2.4. Design for expansion and contraction of the materials.

3.2.5. After cutting, drilling and fitting "treated" wood and plywood but before installation, apply 1 full coat of wood preservative to exposed surfaces, including ends of blocking, furring, nailers and rough carpentry.

3.2.6. Provide fasteners and rough hardware for a rigid and secure installation.

3.2.7. Mix intumescent paint coating product to manufacturer's recommendations. Do not thin or strain. Apply primer and paint coating providing fire resistant barrier in accordance with manufacturer's recommendations to achieve requirements of Authorities Having Jurisdiction. Apply at rate 3.2 m^2/l (125 sq ft/gal) to obtain dry film thickness of 0.25 mm (10 mils).

3.2.8. Miscellaneous Interior Carpentry: Provide plywood, blocking, furring, nailers, rough carpentry, grounds and nailing strips as indicated on Drawings and/or as required for proper installation.

3.3. SITE QUALITY CONTROL

3.3.1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of the Consultant at no cost to the Owner.

3.4. PROTECTION

3.4.1. Protect rough carpentry from weather.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this section.

1.2. SUMMARY

1.2.1. Section Includes: Provide architectural woodwork including but not limited to the following:

1.2.1.1. wood casework.

1.2.1.2. corian surface counters.

1.2.1.3. pulls.

1.2.1.4. standard hinges and glides.

1.2.1.5. laminated casework.

1.2.1.6. casework drawers and doors.

1.2.1.7. edgebanding for casework and casework doors.

1.2.1.8. countertops.

1.2.1.9. casework hardware.

1.2.1.10. interior frames.

1.2.1.11. exterior frames.

1.2.1.12. preservative treatment.

1.2.1.13. panelling.

1.2.2. Related Sections: t h e following description of Work is included for reference only and shall not be presumed complete:

1.2.2.1. Supply of hollow metal doors and frames: Section 08 11 13 - Steel Doors and Frames.

1.2.2.2. Supply of wood doors: Section 08 14 00 - Wood Doors.

1.2.2.3. Glass and glazing: Section 08 80 00 - Glass and Glazing.

1.2.2.4. Building in and anchoring of steel frames in gypsum board partitions: Section 09 21 16 - Gypsum Board.

1.2.2.5. Filling nail holes and provision of finish painting: Section 09 91 00 - Painting.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. AWI/AWMAC/WI: American Woodwork Institute/Architectural Woodwork Manufacturers Association of Canada/Woodwork Institute; www.awmac.com.

1.3.1.2. AWS: Architectural Woodwork Standards, Edition 1, 2009.

1.3.1.3. FSC: Forest Stewardship Council; www.fsccanada.org.

1.3.1.4. MDF: Medium Density Fibreboard.

1.3.1.5. MSDS: Material Safety Data Sheets.

1.3.1.6. NEMA: National Electrical Manufacturers Association; www.nema.org.

1.3.1.7. SCAQMD: South Coast Air Quality Management District; www.aqmd.gov.

1.3.1.8. ULC: Underwriters' Laboratories of Canada; www.ulc.ca.

1.3.1.9. VOC: Volatile Organic Compound.

1.3.2. Reference Standards:

1.3.2.1.	ANSI A208.1-99	- Particleboard
1.3.2.2.	ANSI/NPA A208.2-09	- Medium Density Fiberboard (MDF) For Interior Applications
1.3.2.3.	ANSI/NEMA LD 3-05	- High-Pressure Decorative Laminates
1.3.2.4.	ASTM E84-08a	- Test Method for Surface Burning Characteristics of Building Materials
1.3.2.5.	CSA O112 Series-M77(06)	- CSA Standards for Wood Adhesives
1.3.2.6.	CSA O153-M80(05)	- Poplar Plywood

1.4. SUBMITTALS

1.4.1. Shop Drawings: Submit Shop Drawings for Work of this section in accordance with Section 01 30 00 and section 1 of AWS. Clearly indicate material being supplied and show connections, attachments, reinforcing, anchorage and location of exposed fastenings.

1.4.2. Samples: Submit samples in accordance with Section 01 30 00 samples in following sizes:

1.4.2.1. minimum 300 mm (12") long x 400 mm (16") wide x 25 mm (1") thick solid wood.

1.4.2.2. minimum 300 mm (12") square and of specified thickness, veneer mounted on 19 mm (3/4") particle board and finished as specified.

1.4.2.3. each type of hardware.

1.4.2.4. each plastic laminate in manufacturer's standard chip size.

1.4.2.5. minimum 300 mm (12") square x 25 mm (1") thick countertop materials.

1.5. QUALITY ASSURANCE

1.5.1. Qualifications:

1.5.1.1. Provide work of this section in accordance with sections 10 and 11 of AWS produced by AWI/AWMAC/WI, except as specified otherwise herein and by reference are hereby made a part of this section. Ensure any reference to grades and terminology in this section are as defined in AWS.

1.5.1.2. Requirements of this section govern and modify AWS.

1.5.1.3. Installers: Provide the Work of this section executed by competent installers with a minimum of 5 years' experience in the application of Products, systems and assemblies specified and be a member of AWI/AWMAC/WI.

1.6. DELIVERY, STORAGE AND HANDLING

1.6.1. Delivery and Acceptance Requirements:

1.6.1.1. Do not deliver finished Products during rainy or damp weather.

1.6.1.2. Do not deliver the Work of this section until building and storage areas are sufficiently dry so Products will not be damaged by excessive changes in moisture content.

1.6.1.3. Deliver Products of this section in accordance with Section 2, Rule 4.1.1 of AWS.

1.6.1.4. Do not deliver damaged Products.

1.6.2. Storage and Handling Requirements:

1.6.2.1. Store and handle Products of this section in accordance with Section 2, Rule 4.1.2 of AWS.

1.6.2.2. Cover finished plastic laminate surfaces and varnished surfaces with heavy kraft paper and put in cartons for protection. Protect installed plastic laminate surfaces by acceptable means. Do not remove protective covers until immediately prior to final cleaning.

1.7. WARRANTY

1.7.1. Manufacturer Warranty: Warrant work of this Section for a period of 2 years against defects and/or deficiencies in accordance in Article A-6 of the Contract between Owner and Contractor and GC 37 of the General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to, delamination of plastic laminate, opening of seams, warpage and extensive colour fading.

PART 2 - PRODUCTS

2.1. MATERIALS

2.1.1. Description:

2.1.1.1. Regulatory Requirements: Provide a Pre-Start Health and Safety Review in accordance with the *Occupational Health and Safety Act,* R.S.O. 1990, c. O.1Regulation 851, Industrial Establishments, as amended. Refer to Section 01 40 00 – Quality Requirements for further requirements.

2.1.2. Performance/Design Requirements: Ensure millwork (e.g. countertops, wall cabinets, etc.) are capable of supporting structural loads without deflection in accordance with Casework Integrity in Appendix A of AWS.

2.1.3. Framing Lumber: Select Merchantable Western White Spruce, kiln dried, or sound material of any species may be used for concealed members, free from sap, shakes, knots, splits and other defects.

2.1.4. Architectural Lumber: Clear, straight, kiln dried, Select Yellow Birch for fitments and door jambs. Provide kiln dried lumber to 7% moisture content, free from blemishes that would be apparent after finish is applied.

2.1.5. Plywood: "A" grade selected birch veneer for exposed faces and "B" grade birch veneer for unexposed faces.

2.1.6. Solid Birch: Of uniform grain and colour, premium grade.

2.1.7. High Pressure, Paper Base, Decorative Laminates (PLAM):

2.1.7.1. Products of following manufacturers are acceptable subject to conformance to requirements of the Drawings, schedules and the Specifications:

2.1.7.1.1. Arborite; www.arborite.com

2.1.7.1.2. Formica Inc.; www.formica.com

2.1.7.1.3. Nevamar Company, LLC; www.nevamar.com

2.1.7.1.4. Wilsonart Canada; www.wilsonart.com

2.1.7.1.5. Industrial Laminates/Norplex, Inc.; www.micarta.com

2.1.7.1.6. Pionite Decorative Laminates; www.pionite.com

2.1.7.1.7 Or Equivalent

2.1.7.2. Provide following types and thicknesses conforming to ANSI/NEMA LD 3 and Section 4, Rule 4.2c of AWS:

2.1.7.2.1.	Horizontal General Purpose:	HGS - 1.2 mm (0.048").
2.1.7.2.2.	Horizontal Light Duty:	HGL - 1.0 mm (0.039").
2.1.7.2.3.	Vertical General Purpose:	VGS - 0.7 mm (0.028").
2.1.7.2.4.	Vertical Light Duty:	VGL - 0.5 mm (0.020").
2.1.7.2.5.	Postforming Horizontal:	HGP - 1.0 mm (0.039").
2.1.7.2.6.	Postforming Vertical:	VGP - 0.7 mm (0.028").
2.1.7.2.7.	Cabinet Liner:	CLS - 0.5 mm (0.020").
2.1.7.2.8.	Backer Sheet:	BKV - 0.7 mm (0.028").
2.1.7.2.9.	Backer Sheet:	BKM - 1.0 mm (0.039").
2.1.7.2.10.	Backer Sheet:	BKH - 1.2 mm (0.048").
2.1.7.2.11.	Backer Sheet:	BKL - 0.5 mm (0.020").
2.1.7.2.12.	Special Purpose:	HSH - 3.0 mm (0.118").
2.1.7.2.13.	Special Purpose:	HSM - 1.5 mm (0.059").
2.1.7.2.14.	Flooring Grade, High Wear:	HDH - 3.0 mm (0.118").
2.1.7.2.15.	Flooring Grade, High Wear:	HDM - 1.5 mm (0.059").
2.1.7.2.16.	Flooring Grade, High Wear:	HDS - 1.2 mm (0.048").
2.1.7.2.17.	Flame Retardant:	SGF - 1.5 mm (0.059").
2.1.7.2.18.	Flame Retardant:	HGF - 1.2 mm (0.048").
2.1.7.2.19.	Flame Retardant:	VGF - 0.8 mm (0.032").

2.1.7.3. Colours and Finishes: Provide full colour range including solid, woodgrain and printed patterns, textured, mirror, suede or matte, glossy, high luster/furniture crystal and ashwood finishes. Colours and Product design will be selected later by the Consultant from any or all of above listed manufacturers.

2.1.8. Plastic Laminate Adhesive:

2.1.8.1. Heat-cured urea-formaldehyde type resin in accordance with requirements of CSA O112 Series-M for Work except as otherwise specified in the Contract Documents.

2.1.8.2. Heat-cured resorcinol resin in accordance with requirements of CSA O112 Series-M for wet areas and counter tops with sinks and lavatories built-in.

2.1.9. Wood Cores:

2.1.9.1. Particleboard Laminating Core: Particleboard core of minimum 720 kg/m^3 (45 lbs/cu ft) density conforming to ANSI A208.1, Grade R, sanded both sides.

2.1.9.2. MDF Core: Medium density panels, meeting requirements of ANSI/NPA A208.2, balanced design, manufactured from 100% recycled materials, without the use of formaldehyde resins,, of minimum density of 770 kg/m^3 (48 lb/cu ft) and surface character to match sample in Consultant's possession. Ensure fire retardant Product contains fire-retardant chemicals injected with raw materials during manufacturing and achieve a maximum flame spread rating of 25 with a maximum smoke developed of 200 when tested to ASTM E84. Do not use MDF panels in moist areas. Acceptable Products are "Excel+ MDF" by Uniboard Canada Inc.; www.uniboard.com or Canfibre Group Limited or Equivalent.

2.1.9.3. Plywood Core: Poplar plywood conforming to CSA O153-M, Grades A and B.

2.1.10. **SOLID SURFACE MATERIAL**

2.1.10.1. H omogenous compression moulded material composed of acrylic resins or polyester/acrylic resin blend, fire-retardant filler materials, fibre reinforcement, and colouring agents, conforming to ANSI Z124 and FED WW-P-541E, and meeting the following requirements:

2.1.10.1.1. Manufacturers: Provide Products by the following manufacturers as specified:

2.1.10.1.1.1 The Swan Corporation, contact Nancy Martin, 1-800-325-7008, ext. 227

2.1.10.1.1.2 Corian, as distributed by Willis Supply Company, contact Kelly Robinson, 1-888-994-5547, ext. 379.

2.1.10.1.1.3 Wilsonart, contact Sherrie Beckford, 647-222-2384.

2.1.10.1.1.4 Avonite Surfaces, as distributed by McFadden’s, 1-800-268-0942.

2.1.10.1.1.5 Or Equivalent

2.1.10.2. Adhesives and Colour Matched Silicon Sealants: As recommended by the manufacturer to suit details and conditions.

2.1.10.3. Sheet thickness: 12mm nominal size.

2.1.10.4. Colour (SST1): Colour to Consultant’s later selection.

2.1.11. Finishing:

2.1.11.1. Prime unexposed surfaces including backs of fitments against walls and underside of fitments.

2.1.11.2. Before priming, treat knots and sap streaks, with a coat of shellac and then prime with a wood primer.

2.1.11.3. Shop finish natural finished wood surfaces.

2.1.12. Hardware:

2.1.12.1. Millwork pulls shall be “#527160” in #195 stainless steel finish by Richelieu or equivalent.

2.1.12.2. Provide standard hinges and glides, refer to the Drawings.

2.2. COMPONENTS

2.2.1.1. Exposed Parts Core: Composition board veneer plywood.

2.2.1.2. Exposed Parts Finish: Premium grade in accordance with Section 10, paragraph 1.2.10 of AWS.

2.2.1.3. Semi-Exposed Parts Core: Composition board veneer plywood.

2.2.1.4. Semi-Exposed Parts Finish: Premium grade in accordance with Section 10, paragraph 1.2.11 of AWS.

2.2.2. Casework for Opaque Finish:

2.2.2.1. AWI/AWMAC/WI Quality Grade: Premium.

2.2.2.2. Construction: Ensure casework conforms to Section 10 of AWS.

2.2.2.3. Exposed Parts Core: Composition board veneer.

2.2.2.4. Exposed Parts Finish: Premium grade in accordance with Section 10, paragraph 1.2.10 of AWS.

2.2.2.5. Semi-Exposed Parts Core: Composition board veneer.

2.2.2.6. Semi-Exposed Parts Finish: Premium grade in accordance with Section 10, paragraph 1.2.11 of AWS.

2.2.3. Casework for Plastic Laminate Finish:

2.2.3.1. AWI/AWMAC/WI Quality Grade: Premium.

2.2.3.2. Construction: Ensure casework conforms to Section 10 of AWS.

2.2.3.3. Exposed Parts Core: Composition board veneer.

2.2.3.4. Exposed Parts Finish: Plastic laminate; HGS for horizontal surfaces and VGS for vertical surfaces in accordance with Section 10, paragraph 1.2.10 of AWS.

2.2.3.5. Semi-Exposed Parts Core: Composition board veneer.

2.2.3.6. Semi-Exposed Parts Finish: Plastic laminate; HGS for horizontal surfaces and VGS for vertical surfaces in accordance with Section 10, paragraph 1.2.11 of AWS.

2.2.3.7. Concealed Parts Finish: Backing sheet; BKV.

2.2.4. Edge Banding: 6mm solid wood edge on all exposed edges and adjustable shelf.

2.2.5. Solid Surface Countertops:

2.2.5.1. Ensure front edge type is 6 mm pencil edge. Refer to Drawings.

2.2.6. Exterior Frames:

2.2.6.1. AWI/AWMAC/WI Quality Grade: Premium.

2.2.7. Factory Finishing:

2.2.7.1. Apply finishes in accordance with Section 5 of AWS.

2.2.8. Field Touch-Up: Field touch-up is responsibility of Contractor. Field touch-up includes filling and touch-up of exposed job-made nail and screw holes, refinishing of raw surface resulting from job fitting, repair of job-inflicted scratches and mars and final cleaning up of finished surfaces.

2.2.9. Fabrication:

2.2.9.1. Fabricate joints accurately fitted, coped where possible and well glued up. Fabricate joints mitred to perfect fit and alignments carefully matched.

2.2.9.2. Fabricate finished woodwork in 1 piece where possible. Fabricate running members in the longest lengths obtainable.

2.2.9.3. Fabricate to conceal fastenings.

2.2.9.4. Provide plastic laminate work in shop.

2.2.9.5. Fabricate exposed gables to match the required exposed finishes.

2.2.9.6. Exposed wood construction:

2.2.9.6.1. Fabricate joints carefully matched for grain and colour.

2.2.9.6.2. Fabricate millwork with slow fed machines free from sticker and/or sander markings, with sections and moulding work cut accurately to profiles.

2.2.9.6.3. Sandpaper woodwork, smooth removing burrs, feathers, sleeves, raised grain and sharp arises and leave exposed surfaces perfectly clean and smooth ready for finishing.

2.2.9.6.4. Provide edges noted to be solid, as minimum 6 mm (1/4") thick wood to match exposed veneer, glued to core prior to the application of face veneers.

2.2.9.7. Countertops:

2.2.9.7.1. Fabricate and assemble countertops and splashbacks in shop to profiles and lengths indicated in the Drawings.

2.2.9.7.2. Fabricate cutouts for services penetrations.

2.2.9.7.3. Verify governing dimensions before fabricating items which abut wall surfaces.

2.2.9.7.4. Provide cutouts and round internal corners, chamfer edges and seal exposed core.

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions: Verify the actual Site dimensions and location of adjacent materials prior to commencing Work. Notify Consultant in writing of any conditions which would be detrimental to the installation.

3.1.2. Evaluation and Assessment: Commencement of Work implies acceptance of previously completed work.

3.2. INSTALLATION

3.2.1. Install Work of this section in accordance with appropriate section of AWS.

3.2.2. Provide Work of this section true and straight and securely fastened in place.

3.2.3. Mitre exposed corners and butt joints.

3.2.4. Provide solid surface countertops plumb and true, neatly scribed to adjoining surfaces.

3.2.5. Thoroughly fix and anchor Work of this section into position.

3.2.6. Mechanical and Electrical Fittings:

3.2.6.1. Provide openings required to accommodate mechanical and electrical fittings as part of the Work of this Section and provide a core sealant to protect counter cores which are exposed to accommodate:

3.2.6.1.1. mechanical services and fittings.

3.2.6.1.2. washroom accessories.

3.2.6.2. Mechanical and electrical fittings and services will be provided as part of the Work of Divisions 21, 22, 23, 26, 27 and 28.

3.2.7. Installation of Hardware:

3.2.7.1. Install architectural woodwork hardware in accordance with manufacturer's requirements and templates. Adjust architectural woodwork hardware to provide smooth operation and ensure clearances are maintained. Repair damage to adjacent surfaces resulting from failure to conform with this requirement.

3.2.7.2. Provide lubricants required and use in manner to ensure smooth function of hardware consistent with manufacturer's recommendations.

3.2.7.3. Verify fastening components are tightened securely. Align screws, bolts and similar fastenings such that relationship of screw head indentations, similar surfaces and slots are perpendicular to matching vertical or horizontal position when on same surface. Do not burr or otherwise mar edges of surfaces of hardware components. Repair defects caused by work of this section in an acceptable manner.

3.2.8. Millwork pulls shall be “#527160” in #195 stainless steel finish by Richelieu or Equivalent.

3.2.9. Do not install damaged Products.

3.2.10. Solid Surfacing Material:

3.2.10.1. Fabricate components in shop to the greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings.

3.2.10.2. Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids.

3.2.10.3. Provide holes and cutouts for plumbing and accessories, as indicated on the Drawings.

3.2.10.4. Rout and finish component edges to a smooth, uniform finish.

3.2.10.5. All surfaces shall have a uniform finish.

3.3. SITE QUALITY CONTROL

3.3.1. Non-Conforming Work: Replace damaged Work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of the Consultant at no cost to Owner.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this section.

1.2. SUMMARY

1.2.1. Section Includes: Provide general installations including but not limited to following:

1.2.1.1. installation of hollow metal doors and frames.

1.2.1.2. spot grouting of door frames in gypsum board partitions.

1.2.1.3. installation of finish hardware.

1.2.2. Related Sections: the following description of Work is included for reference only and shall not be presumed complete:

1.2.2.1. Provision of architectural woodwork: Section 06 40 00 - Architectural Woodwork.

1.2.2.2. Supply of hollow metal doors and frames: Section 08 11 13 - Steel Doors and Frames.

1.2.2.3. Supply of wood doors: Section 08 14 00 - Wood Doors.

1.2.2.4. Installation of gypsum wall board partition steel frames and wall boards: Section 09 21 16 - Gypsum Board.

1.2.2.5. Mechanical fittings and services: Division 22 - Plumbing.

1.2.2.6. Electrical fittings and services: Division 26 - Electrical.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. DHI: Door and Hardware Institute Canada; www.dhicanada.ca.

1.3.1.2. MSDS: Material Safety Data Sheets.

1.3.1.3. NFPA: National Fire Protection Association; www.nfpa.org.

1.3.1.4. SCAQMD: South Coast Air Quality Management District; www.aqmd.gov.

1.3.1.5. VOC: Volatile Organic Compound.

1.3.2. Reference Standards:

1.3.2.1.	ANSI/WDMA I.S. 1A-04	- Industry Standard for Architectural Flush Wood Doors
1.3.2.2.	ASTM C305-06	- Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency
1.3.2.3.	ASTM C1107/C1107M-06	- Standard Specification for Packaged Dry Hydraulic-Cement Grout (Non-Shrink)
1.3.2.4.	NFPA 80-07	- Standard for Fire Doors and Fire Windows

1.3.2.5. CAN/ULC-S702-97 - Standard for Thermal Insulation Mineral Fibre, for Buildings

1.4. ADMINISTRATIVE REQUIREMENTS

1.4.1. Preinstallation Meeting:

1.4.1.1. Prior to commencement of the Work, arrange for the Site meeting of parties associated with the Work of this Section. Presided over by the Contractor, include the Consultant, Subcontractor(s), testing company's representative and the manufacturer's representative.

1.4.1.2. Review Work included under this section and determine complete understanding of requirements and responsibilities relative to Work included, storage and handling of hardware, hardware to be used, installation of methods and procedures related to electrified door hardware, sequence and quality control, Project staffing, restrictions on areas of Work and other matters affecting construction, to permit compliance with intent of this section. Also discuss following items:

1.4.1.2.1. electrical roughing in and other preparatory work performed by other trades.

1.4.1.2.2. sequence of operation of each type of electrified door hardware.

1.4.1.2.3. construction schedule and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

1.4.1.2.4. required testing, inspecting and certifying procedures.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are acceptable subject to conformance to requirements of the Drawings, schedules and the Specifications:

2.1.1.1. ChemRex Inc.; www.chemrex.com

2.1.1.2. CPD Construction Products; www.cpd.ca

2.1.1.3. Euclid Canada; www.euclidchemical.com

2.1.1.4. Sika Canada Inc.; www.sikacanada.com

2.1.1.5. W.R. Meadows of Canada; www.wrmeadows.com

2.1.1.6 or Equivalent

2.2. MATERIALS

2.2.1. Description:

2.2.1.1. Regulatory Requirements: Provide a Pre-Start Health and Safety Review in accordance with the *Occupational Health and Safety Act, R.S.O. 1990, c. O.1*, Regulation 851, Industrial Establishments, as amended. Refer to Section 01 40 00 – Quality Requirements for further requirements.

2.2.2. Doors, Frames and Hardware: Refer to the following sections for Products to be installed as part of the Work of this section:

2.2.2.1. Section 06 40 00 -Architectural Woodwork.

2.2.2.2. Section 08 11 13 - Steel Doors and Frames.

2.2.2.3. Section 08 14 00 - Wood Doors.

2.2.3. Spot Grout: Proportion when used at metal door frames; 1 part hardwall plaster to not more than 2-1/2 parts "Perlite" by weight, with enough water added for "hand pack" consistency and/or use "Gyproc 90" by Georgia-Pacific Canada, Inc. or "Durabond 90" by CGC Inc. or Equivalent.

2.2.4. Threshold Sealant: As recommended by installer in accordance with Section 07 92 00 - Joint Sealants.

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions: Verify actual Site dimensions and location of adjacent materials prior to commencing Work. Verify frames comply with indicated requirements for type, size, location, swing characteristics and have been installed with plumb jambs and level heads. Notify the Consultant in writing of any conditions which would be detrimental to the installation.

3.1.2. Evaluation and Assessment: Commencement of Work implies acceptance of previously completed work.

3.2. INSTALLATION

3.2.1. Hollow Metal Frames:

3.2.1.1. Install hollow metal frames in accordance with manufacturer's instructions.

3.2.1.2. Set frames plumb, square, level and at correct elevation, maintaining uniform door width and height.

3.2.1.3. Secure anchorages and connections to adjacent construction.

3.2.1.4. Remove temporary steel shipping jamb spreaders prior to setting 1-piece welded frames. Brace frames rigidly in position while being built in. Use precisely-dimensioned installation spreaders at sill and third-points of door opening height to maintain door opening width during building-in. Follow manufacturer’s instructions regarding proper use of floor and jamb anchors. Remove installation spreaders only after mortar has set, where applicable.

3.2.1.5. Allow for deflection to prevent structural loads from being transmitted to frame.

3.2.1.6. Spot Grouting:

3.2.1.6.1. Coordinate spot grouting with Section 09 21 16 - Gypsum Board.

3.2.1.6.2. Provide spot grout to increase rigidity of frame and improve resistance to frame rotation caused by weight of door.

3.2.1.6.3. Comply with manufacturer’s recommendations for surface preparation, cleaning, forming, mixing, placement and curing of grout.

3.2.1.6.4. Mix grout in accordance with ASTM C305 requirements.

3.2.1.6.5. Spot grout at strike and hinge side jambs at steel door frames set in gypsum board partitions, walls and other similar locations in accordance with manufacturer’s recommendations. Immediately insert gypsum panels into jamb and attach to framing. Do not terminate gypsum board against trim.

3.2.1.6.6. Do not use pumped slurry method to perform spot grouting.

3.2.2. Wood Doors:

3.2.2.1. Install wood doors in accordance with manufacturer's instructions and recommendations of ANSI/WDMA I.S. 1A.

3.2.2.2. Condition doors to average temperature and humidity in area of installation for not less than 48 hours prior to installation.

3.2.2.3. Install doors in a neat and workmanlike manner free from hammer or tool marks, open joints or slivers.

3.2.2.4. Set plumb, level, square and true. Install doors after building humidity is at an acceptable level.

3.2.2.5. Install in accordance with following edge clearances unless otherwise indicated:

3.2.2.5.1. Between doors and frames: at head and jambs: 3 mm (1/8").

3.2.2.5.2. At door bottom: 9 mm (3/8") maximum unless doors are indicated to be undercut.

3.2.2.5.3. Between meeting edges of pairs of doors: 3 mm (1/8").

3.2.2.6. Cut, drill and prepare doors to template to receive hardware.

3.2.2.7. Ensure smoke gaskets are in-place before pre-finished door installation.

3.2.3. Finish Hardware:

3.2.3.1. Install hardware to doors and frames in accordance with manufacturer's packaged installation, template and adjusting instructions.

3.2.3.2. Adjust hardware to provide smooth operation of doors and ensure clearances are maintained. Provide lubricants to allow smooth function of hardware consistent with manufacturer's recommendations.

3.2.3.3. Mount hardware at heights in accordance with the "Recommended Locations for Builder's Hardware" by DHI Canada except as otherwise indicated in the Contract Documents or required by the Authorities Having Jurisdiction.

3.2.3.4. Install door louvres and frame bumpers.

3.2.3.5. Tighten fastening components snugly. Do not burr or otherwise mar the edges of surfaces of hardware components. Repair defects resulting from the Work of this section in accordance with the Consultant's review.

3.2.3.6. Set exterior door thresholds in a continuous bed of sealant to prevent water and air intrusion beneath sill.

3.2.3.7. Unless otherwise indicated in the Contract Documents, mounting heights for door hardware is as follows:

3.2.3.7.1. Locksets - 1023 mm (40-5/16") from floor to centre line of knob.

3.2.3.7.2. Deadlocks - 1524 mm (60") from floor to centre line of cylinder.

3.2.3.7.3. Panic Bolts - 1023 mm (40-5/16") from floor to centre line of bar.

3.2.3.7.4. Pulls - 1041 mm (41") from floor to centre line of pull.

3.2.3.7.5. Push Plates - 1143 mm (45") from floor to centre line of plate.

3.2.3.7.6. Guard Bars - 1066 mm (42") from floor to centre line of bar.

3.2.3.8. Provide locked room for storage of finish hardware at the job Site and a person responsible for control and distribution of finish hardware.

3.3. SITE QUALITY CONTROL

3.3.1. Non-Conforming Work: Replace damaged Work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of the Consultant at no cost to Owner.

3.4. ADJUSTING

3.4.1. Adjust doors and hardware and other moving or operating parts to function smoothly and correctly.

3.5. CLEANING

3.5.1. Carefully wipe clean doors of dust created due to the Work of this project.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this Section.

1.2. SUMMARY

1.2.1. Section Includes: Provide firestopping and smoke seals including but not limited to the following:

1.2.1.1. firestopping and smoke seals in accordance with Ontario Building Code and Fire Code requirements, at openings and around penetrations, at un-penetrated openings, at projecting and recessed items and at openings and joints within fire separations and assemblies having fire resistance rating, excluding those inside sealed mechanical and electrical assemblies (e.g. inside ducts, dampers, bus ducts etc.).

1.2.1.2. firestopping and smoke seals in accordance with Code requirements, at openings and spaces at perimeter edge conditions, excluding those inside sealed mechanical and electrical assemblies (e.g. inside ducts, dampers, bus ducts etc.).

1.2.1.3. firestopping and smoke seals edge of slab.

1.2.1.4. ensure seal provides and maintains a fire-resistance rating as determined by OBC for adjacent floor, wall or other fire separation assembly to requirements of and as acceptable to Authorities Having Jurisdiction and to the Consultant.

1.2.1.5. firestopping and smoke seals in and around fire separations, including spaces around mechanical and electrical penetrations, at tops of fire walls, between slab edges and other gaps and penetrations at fire assemblies.

1.2.1.6. ensure Divisions 21, 22, 23, 26, 27 and 28 respectively are responsible for firestopping and smoke seals within mechanical (i.e. inside ducts, dampers) and electrical assemblies (i.e. inside electrical bus ducts). Ensure firestopping and smoke seals around outside of such mechanical and electrical assemblies where they penetrate fire-rated separations are part of the Work of this Section.

1.2.1.7. systems and specified Products are only a guide and may not address all firestopping conditions pertaining to situations which may be present in the Work. Provide firestopping and smoke seal required for the Work. These Products and systems are not presented to restrict other tested and approved listed assemblies of other manufacturers designing assemblies conforming to Code and resolving firestopping required for the Work.

1.2.2. Related Sections: the following description of Work is included for reference only and shall not be presumed complete:

1.2.2.1. Sealants and caulking: Section 07 92 00 - Joint Sealants.

1.2.2.2. Gypsum board partitions: Section 09 21 16 - Gypsum Board.

1.2.2.3. Firestopping and smoke seals inside mechanical assemblies: Division 21, Fire Suppression, Division 22, Plumbing and Division 23, Heating Ventilating and Air Conditioning.

1.2.2.4. Firestopping and smoke seals inside electrical assemblies: Division 26, Electrical, Division 27, Communications and Division 28, Electronic Safety and Security.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. MSDS: Material Safety Data Sheets.

1.3.1.2. OBC: Ontario Building Code, 2006.

1.3.1.3. SCAQMD: South Coast Air Quality Management District; www.aqmd.gov.

1.3.1.4. UL: Underwriters Laboratories Inc.; www.ul.com.

1.3.1.5. ULC: Underwriters' Laboratories of Canada; www.ulc.ca.

1.3.1.6. VOC: Volatile Organic Compound.

1.3.2. Definitions:

1.3.2.1. Firestop System Types:

1.3.2.1.1. Head of Wall Joint Firestop Systems: (HW): Systems intended for installation in vertical separations between wall and floor or roof structures. Ensure these systems do not incorporate penetrating items such as pipes or cables.

1.3.2.1.2. Joint Firestop Systems (JF): Systems intended for installation in openings such as construction joints, gaps and spaces in floors or walls or at floor and wall intersections in accordance with approved systems. Ensure these systems do not incorporate penetrating items such as pipes or cables.

1.3.2.1.3. Perimeter Joint Firestop Systems (PJ): Perimeter joint firestop system rating are governed by lowest of fire resistance ratings of individual components (i.e. the wall, floor or joint system). These systems consist of floor with fire endurance rating, exterior wall with or without fire endurance rating and perimeter joint system. Ensure these perimeter joint firestop systems do not incorporate penetrating items such as pipes or cables.

1.3.2.1.4. Service Penetration Firestop Systems (SP): Systems intended for installation in openings of limited dimensions and shape in floor or wall assemblies in accordance with approved systems. Ensure penetrating pipes, cable trays and similar items are in exact accordance with approved systems.

1.3.2.1.5. Service Penetration for Combustible Systems (SPC): Systems intended for installation in openings of limited dimensions and shape in floor or wall assemblies in accordance with systems approved by the Consultant. . These systems are tested with a minimum differential pressure of 50 Pa between exposed and unexposed surfaces of assembly to meet Code requirements for Combustible Pipes for Use in Drain, Waste and Vent Piping.

1.3.2.2. Ratings: Rating of firestop system applies to its use in specific assembly of materials, penetration and floor or walls in which it is tested as follows:

1.3.2.2.1. F Rating: When system remains in opening during fire test for rating period without permitting passage of flame through openings or occurrence of flaming on any element of unexposed side of assembly.

1.3.2.2.2. FT Rating: When system remains in opening during fire test in accordance with F Rating requirement and additionally, transmission of heat through firestop system during rating period shall not have been such as to raise temperature of any thermocouple on unexposed surface of system more than 163 deg C (325 deg F) above initial temperature.

1.3.2.2.3. FH Rating: When system remains in opening during fire and hose test in accordance with F Rating requirement and additionally, during hose stream test firestop system shall not develop any opening that would permit a projection of water from stream beyond unexposed side.

1.3.2.2.4. FTH Rating: When system remains in opening during fire test and hose stream test within limitations described for F, FT and FH ratings.

1.3.2.2.5. L Rating: Based on volume of air flowing, per unit of time through opening around test sample under specified pressure difference applied across surface of system. L Ratings are intended to determine acceptability of firestop systems with reference to control of air movement through assembly. Rating is expressed in litres per second (l/s) per linear metre of opening for joint systems.

1.3.3. Reference Standards:

1.3.3.1.	NFPA 101-09	- Life Safety Code
1.3.3.2.	CAN/ULC-S101-07	- Standard Methods of Fire Endurance Tests of Building Construction and Materials
1.3.3.3.	CAN/ULC-S102-07	- Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
1.3.3.4.	ULC-S115-05	- Standard Method of Fire Tests of Firestop Systems
1.3.3.5.	ULC Guide No. 40 U19	- Firestop Systems
1.3.3.6.	ULC Guide No. 40 U19.13	- Firestop Systems Components

1.4. ADMINSTRATIVE REQUIREMENTS

1.4.1. Preinstallation Meetings: Prior to commencement of sealing, arrange for Product manufacturer's knowledgeable representative to meet and discuss installation procedures and unique conditions at the Place of the Work, inspect substrate surfaces and recommend solutions to accommodate adverse conditions, periodically visit and verify installations before being concealed and report unsatisfactory conditions to the Contractor, attend final inspection and to submit written certification that Products, systems and assemblies have been installed in accordance with manufacturer's requirements.

1.4.2. Scheduling: Coordinate with Subcontractors involved and advise dates where work will take place throughout various areas of work.

1.5. SUBMITTALS

1.5.1. Product Data: Submit manufacturers' specifications and technical data for each material including compositions, limitations, documentation conforming to ULC firestop system proposed for this project and the manufacturers' installation instructions.

1.5.2. Shop Drawings:

1.5.2.1. Submit Shop Drawings in accordance with Section 01 30 00 – Administrative Requirements. Submit complete and detailed Shop Drawings for each condition encountered on site. Indicate following:

1.5.2.1.1. ULC assembly number certification and material safety data sheets.

1.5.2.1.2. required temperature rise and flame rating.

1.5.2.1.3. hose stream rating (where applicable).

1.5.2.1.4. thickness.

1.5.2.1.5. proposed installation methods.

1.5.2.1.6. material of firestopping and smoke seals, primers, reinforcements, support and securement methods, damming materials, reinforcements and anchorages /fastenings.

1.5.2.1.7. size of opening.

1.5.2.1.8. adjacent materials.

1.5.2.1.9. number of penetrations.

1.5.2.2. Designate on Shop Drawings fixed penetrants, relative positions, number of penetrations, expansion and control joints in rated slabs and walls, firestopping details at receptacles and similar poke-through devices and surrounding permanent materials. Identify re-entry locations.

1.5.2.3. Submit fireproofing manufacturer's written verification that manufacturers have identified where firestopping is required, have selected correct firestop system and applicators have been trained by system manufacturers. Products, systems and assemblies have been installed in accordance with manufacturer's requirements.

1.5.3. Samples: Submit only as requested and in accordance with Section 01 30 00 – Administrative Requirements, various types of firestopping and smoke seal material.

1.5.4. Certificates:

1.5.4.1. Submit manufacturer's verification that installed firestopping and smoke seal materials comply with specified requirements.

1.5.4.2. Submit copies of ULC and/or Warnock Hersey Listing cards for review.

1.6. CLOSEOUT SUBMITTALS

1.6.1. Operational and Maintenance Data: Provide maintenance data for materials and prefabricated devices, providing descriptions sufficient for identification on Site in accordance with requirements of Section 01 70 00 - Execution and Closeout Requirements.

1.7. QUALITY ASSURANCE

1.7.1. Qualifications:

1.7.1.1. Installers: Provide the work of this Section executed by competent installers experienced, trained, licensed and approved, by material or system manufacturer for application of materials and systems being used having a minimum of 5 years' experience in application of Products, systems and assemblies specified. Ensure firestopping systems conform to requirements of ULC-S115 tested assemblies that provide fire rating as shown.

1.8. DELIVERY, STORAGE AND HANDLING

1.8.1. Delivery and Acceptance Requirements: Deliver materials to the Site in the manufacturer's sealed and labelled containers. Materials are subject to Consultant's inspection.

1.8.2. Storage and Handling Requirements:

1.8.2.1. Store materials inside building for 24 hours prior to use; store in area designated by Consultant. Protect from damage and environmental conditions detrimental to material.

1.8.2.2. Comply with manufacturer's temperature, relative humidity and substrate moisture content for storage, mixing, application and curing of Products.

1.9. SITE CONDITIONS

1.9.1. Ambient Conditions:

1.9.1.1. Comply with the manufacturer's recommended requirements for temperature, relative humidity, moisture content and presence of any sealer or release agents on substrate during application and curing of materials. Ensure surfaces are dry and frost free.

1.9.1.2. Maintain minimum temperature of 5 deg C (40 deg F) for minimum period of 1 week before application, during application and until application is fully cured.

1.9.1.3. Ventilate areas in which firestopping is being applied. Protect water-soluble material from wetting until fully cured.

1.10. WARRANTY

1.10.1. Manufacturer Warranty: Warrant work of this Section against defects and deficiencies for period of 5 years in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within the warranty period, to satisfaction of the Consultant and at no additional expense to the Owner. Defects include but are not limited to cracking, breakdown of bond, failure to stay in place or bleeding.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are acceptable subject to conformance to requirements of the Drawings, schedules and the Specifications:

2.1.1.1. A/D Fire Protection Systems Inc.; www.adfire.com

2.1.1.2. GE Canada, Inc.; www.gesilicones.com

2.1.1.3. Electrical Products Division/3M; www.3m.com

2.1.1.4. Grace Construction Products; www.graceconstruction.com

2.1.1.5. Instant Firestop Inc.

2.1.1.6. Hilti (Canada) Corporation; www.ca.hilti.com

2.1.1.7. Johns Manville, Fire Protection Systems; www.jm.com

2.1.1.8. M.W. McGill and Associates Ltd.

2.1.1.9. Nelson Firestop Products; www.nelsonfirestop.com

2.1.1.10. ThermoFire Systems Inc.

2.1.1.11. Thomas & Betts Ltd.

2.1.1.12. Tremco Canada; www.tremcosealants.com

2.1.1.13 Or equivalent

2.1.2. Substitution Limitations: Comparable Products from manufacturers listed herein will be accepted

provided they meet requirements of this Specification.

2.2. MATERIALS

2.2.1. Description:

2.2.1.1. Regulatory Requirements: Where required, provide a Pre-Start Health and Safety Review in accordance with the *Occupational Health and Safety Act, R.S.O. 1990, c. O.1*, Regulation 851, Industrial Establishments, as amended. Refer to Section 01 40 00 - Quality Requirements for further requirements.

2.2.2. Performance/Design Criteria: Ensure firestop systems intended for installation in fire separations have assigned fire ratings as defined herein when tested in accordance with ULC-S115. Ensure firestop systems intended for use in fire resistive wall and/or floor assemblies are evaluated in accordance with CAN/ULC-S101 (Refer to ULC Guide No. 40 U19).

2.2.3. Head of Wall Joint Firestop Systems: (HW): Supply materials and systems capable of effectively impeding passage of fire, smoke, gasses and where specifically indicated on the Drawings. Use only firestop systems that have been ULC tested for specific fire rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements and fire rating involved for each separate instance.

2.2.4. Ensure firestopping system provides fire-resistance rating, flame and temperature not less than fire resistance rating of surrounding floor, wall or assembly, in accordance with requirements of OBC.

2.2.5. Firestop System Rating: Where applicable, comply with F rating based on number of hours system can resist flames and gases; T rating based on maximum temperature rise of 163 deg C (325 deg F) above ambient for any thermocouple in addition to flame, gas and stream performance and H rating based on capacity to withstand hose stream after burn. Design combined and/or built-up Site systems in accordance with approved restrictions and technical evaluations acceptable to the Consultant and Authorities Having Jurisdiction.

2.2.6. Ensure systems provide fire and temperature rating in accordance with those outlined in OBC and effectively impeding passage of flame, smoke and gasses.

2.2.7. Firestopping seals except for wall joints in visible areas must be of easily identifiable colour, such as red or yellow to be clearly distinguished from other building materials.

2.2.8. Ensure service penetration components and assemblies, including back-up materials and supports are certified in accordance with ULC-S115 or CAN/ULC-S101 and be ULC listed by a certified authority recognized by Building Code officials in the Town of Newmarket.

2.2.9. Ensure suitability of Products for application and compatibility of materials with surfaces to which it will be applied.

2.2.10. Ensure Site system assembly is in accordance with ULC-S115 labeled and listed system design limitations, unless proposed assembly is approved by Authorities Having Jurisdiction and meets Consultant's approval. Design combined and/or built-up Site systems in accordance with approved restrictions and technical evaluations acceptable to Consultant and Authorities Having Jurisdiction. Engineering judgements from firestopping manufacturers reviewed by the Consultant and Authorities Having Jurisdiction may be used for conditions where a ULC firestopping system is not available.

2.2.11. Ensure sealants and putty for overhead and vertical joints are non-sagging; seals for floors, self- levelling. Ensure flexible fire stop sealant provides movement capability in fire rated joint applications. Ensure sealants are compatible with base materials such as without limitations masonry, concrete, metal, gypsum board and other similar items.

2.2.12. Ensure Products have a compressive strength capable of providing self-support at a penetrating item and shall maintain their integrity as tested in a ULC vertical application.

2.2.13. Ensure Products are compatible with abutting dissimilar architectural coatings and finishes at floors, walls, ceilings, waterproofing membranes and the like. Review Drawings and check the manufacturer of selected materials being installed.

2.2.14. Integral Pipe Sleeves/Firestopping Components: Other Sections within Divisions 21, 22 and 23 may specify fire-rated pipe sleeves, cast-in pipe/sleeve assemblies and integral firestopped penetration devices and accessories listed by authorized testing and certification authorities. These systems may eliminate need for separate firestopping applications at certain designated locations and it is responsibility of this Section to determine any and all locations where such devices will be utilized on project.

2.2.15. Do not provide Products containing asbestos.

2.2.16. Firestopping System 1 (JF Systems):

2.2.16.1. This Firestopping System is primarily an expansion, control and perimeter seal without smoke resistance and be non-combustible, semi-rigid, felt fire protection. Certified assembly of 1 of listed manufacturers or Equivalent and acceptable to the Consultant.

2.2.16.2. Ensure blanket type firestopping is listed and labelled in accordance with ULC Guide No. 40 U19 or 40 U19.13, with reference to `JF System Listings'.

2.2.16.3. Where required by listing, ensure impaling clips are heavy gauge galvanized wire or 25 mm (1") wide x 0.607 mm (24 ga) galvanized steel, Z formed with horizontal bottom and dimensions conforming to location of firestopping and width of void to be filled. Ensure compression of joint do not damage clips.

2.2.17. Firestopping System 2: Same materials as in System 1, but without use of impaling clips and with smoke and fluid seal with hose stream resistance. Certified assembly of 1 of listed manufacturers or Equivalent and acceptable to the Consultant.

2.2.18. Firestopping System 3: Fire, gas, fluid and hose stream resistant elastomeric sealant with movement capabilities, ULC labeled assembly of 1 of listed manufacturers or Equivalent and acceptable to the Consultant. Ensure materials have elastic characteristics where used at openings subject to movement. Intumescent pads may form part of this system, at the Contractor’s option.

2.2.19. Firestopping System 4: Ensure firestopping, gas, fluid and hose stream resistant seals at openings intended for ease of re-entry such as cables be an elastomeric seal or proprietary assembly of following types; a cementitious or rigid seal at such locations is not permitted. Certified assembly of 1 of listed manufacturers or Equivalent and acceptable to the Consultant.

2.2.20. Firestopping System 4-A: Where openings are considered large such as at cable trays and bus ducts. Certified assembly of 1 of listed manufacturers or Equivalent and acceptable to the Consultant.

2.2.21. Firestopping System 5 (Cavity Wall Compartment Closer and Firestopping): Strips of "RXL Safe" semi-rigid mineral fibre insulation by Roxul Inc. 75 mm (3") wide by depth of cavity plus 13 mm (1/2") with galvanized skewers for securement at 300 mm (12") oc., or compressed 25% to fill depth of cavity.

2.2.22. Primers: To manufacturer's recommendations for specific material, substrate and end use.

2.2.23. Framing and Backup Materials, Supports and Anchoring Devices: Non-combustible, to manufacturer's recommendations in accordance with tested assembly being installed and as acceptable to Authorities Having Jurisdiction. Ensure sheet steel covers over temporarily unused sleeves in tenant and similar spaces are minimum 0.912 mm (20 ga) thick galvanized sheet steel formed to a tight fit over opening with specified firestopping materials installed beneath. Combustible materials are acceptable only if they are approved under ULC systems, otherwise they should be removed after permanent firestop materials have cured.

2.2.24. Pipe and Duct Insulation and Wrappings Compatible with Firestopping Systems: "Nelson WRP" by Nelson Electric Ltd. for use with Nelson Electric Ltd. firestops and "Instant Type PI" by Instant Firestop Inc. for use with Instant Firestop Inc. firestops; or "TREMstop WS" by Tremco Canada; or Equivalent.

2.2.25. Intumescent Pads: “FSP 1077" by Grace Construction Products or "FSP Pads" by Nelson Electric, or "Instant Putty 200" by Instant Firestop Inc., or "Type PLW Firestop Pillow" by Electrovert Ltd.; or Equivalent.

2.2.26. Re-Entry Pillows: Permanently pliable, “FSPIL Pillows" by Grace Construction Products or "Type PLW Firestop Pillow" by Electrovert; or "PLW" by Nelson Electric; or "TREMstop PS" by Tremco Canada; or Equivalent.

2.2.27. Mixes:

2.2.27.1. Mix materials at correct temperature and in accordance with manufacturer's directions.

2.2.27.2. Cleaning Materials: As recommended by firestop manufacturer.

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions:

3.1.1.1. Verify actual Site dimensions and location of adjacent materials prior to commencing Work. Notify Consultant in writing of any conditions which would be detrimental to the installation.

3.1.1.2. Verify openings, dimensions and surfaces conform to fire and smoke seal assembly.

3.1.1.3. Examine sizes of penetrating service, percentage fill and sleeve or opening sizes with exact annular space calculations, anticipated movement and conditions necessary to establish correct type, thickness and installation of back-up materials and seals.

3.1.2. Evaluation and Assessment: Commencement of Work implies acceptance of previously completed work.

3.2. PREPARATION

3.2.1. Surface Preparation:

3.2.1.1. Provide primer or surface conditioner if required by Product manufacturer. Prime surfaces in accordance with manufacturer's directions.

3.2.1.2. Remove combustible material and loose material detrimental to bond from edges of penetration. Clean, prime or otherwise prepare substrate material to manufacturer's recommendation.

3.2.1.3. Remove insulation from insulated pipe and duct where such pipes or ducts penetrate a fire separation unless ULC certified assembly permits such insulation to remain within assembly, or where mechanical trades have installed special fire rated insulated sleeves. Ensure continuity of thermal and vapour barriers where such are removed, altered or replaced, to satisfaction of Divisions 21, 23, 23 and the Consultant.

3.2.1.4. Alternatively, ensure pipe and duct insulation and wrappings occurring within openings to receive firestopping and smoke seals under this Section are installed prior to Work of this Section and insulation and wrappings within fire seals are ULC listed components of system to be installed under this Section, unless ULC certified assembly permits such other insulation and wrappings to remain within assembly. Coordinate the Work of this Section with Divisions 21, 22 and 23.

3.2.1.5. Clean bonding surfaces to remove deleterious substances including dust, paint, rust, oil, grease, moisture, frost and other foreign matter which may otherwise impair effective bonding.

3.3. INSTALLATION

3.3.1. Do not apply firestop material to surfaces previously painted or treated with sealer, curing compound, water repellent to other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings which prohibit firestop from being applied.

3.3.2. Provide temporary forming, packing and bracing materials necessary to contain firestopping. Upon completion, remove forming and damming materials not required to remain as part of system.

3.3.3. Install damming and firestopping materials as per manufacturer's instructions.

3.3.4. Mix and apply firestopping and smoke seals in accordance with manufacturer's instructions and tested designs to provide required fire (temperature and flame) rated seal, to prevent passage of smoke and where specifically designated, passage of fluids.

3.3.5. Provide temporary forming and packing if required. Apply materials with sufficient pressure to properly fill and consolidate mass to seal openings.

3.3.6. Tool or trowel exposed surfaces. Allow materials to cure by not covering up materials until full curing has taken place.

3.3.7. Where a designated system described hereinafter does not meet Code requirements for particular service condition, substitute with next higher system meeting required rating.

3.3.8. Notify the Consultant when completed installations are ready for inspection and prior to concealing or enclosing firestopping and smoke seals.

3.3.9. System 1:

3.3.9.1. Install fire rated joint firestopping by compressing material minimum of 25% to ensure complete sealing and to follow irregularities of concrete slabs at perimeter of building where junction occurs with back of cladding system. Apply firestopping sealant of spray over compressed mineral wool.

3.3.9.2. Butt succeeding sections of firestopping material tightly up against preceding. Leave no voids.

3.3.9.3. Provide firestopping between exterior wall cladding and concrete floor slab. Secure and support to suit design requirements.

3.3.9.4. Use this system for joint seals through fire-resistance rated floor slabs, ceilings and roofs.

3.3.10. System 2:

3.3.10.1. At fire-rated masonry walls and gypsum board partitions which extend nominally to within 19 mm (3/4") of underside of deck above, insert fire rated joint assembly firestopping material in 25% compression in accordance with ULC test requirements and manufacturer's instructions. Provide adequate depth of material to fill gap flush with face of wall. Apply firestopping sealant of spray over compressed mineral wool.

3.3.10.2. Insert at intersection of fire-resistance rated masonry and gypsum board partitions.

3.3.10.3. Insert at both sides of control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

3.3.10.4. Where wall/slab junction is exposed in finished work, keep fibre back 9 mm (3/8") from face of block and apply fire-resistant sealant to gap, tooling to a concave joint.

3.3.10.5. At perimeter slab locations where this system would otherwise be exposed in finished Work and where smoke seal is required, provide cover spray material of thickness as recommended by manufacturer of System 3 material set flush with top of slab and tooled smooth. Minimum

cover spray thickness 3 mm (1/8"). Where anticipated movement in joint width is inevitable, select sealant with elastic capabilities.

3.3.11. System 3:

3.3.11.1. This system establishes fire rated firestopping for service penetrations throughout the project. Seal gaps and holes in fire-rated walls and slabs and composite construction through which conduit, wire, cables, ductwork, piping and other protrusions pass as a result of work using fire-resistant penetration sealant. Include opening which have been formed, sleeved and cored.

3.3.11.2. Apply at unpenetrated openings and sleeves installed for future use through fire-resistance rated assemblies.

3.3.11.3. Apply this system between spaces having different air pressures. (See mechanical Drawings for pressurized areas and locations of moving penetrants.)

3.3.11.4. Apply at "wet" rooms supported by suspended slabs at locations over electrical and equipment rooms or similar areas containing power devices in which future re-entry is not required.

3.3.11.5. Apply at mechanical rooms and similar rooms having systems containing liquids, including piping runs, unless such rooms are located over slab-on-grade.

3.3.11.6. Install System 3 materials at elevator shafts, duct shafts and other similar locations over occupied spaces.

3.3.11.7. Install 6 mm to 9 mm (1/4" to 3/8") bead of firestop caulking at interface of retaining angles around fire dampers, where angles meet fire-rated assembly and between retaining angles and fire damper, both sides of penetration. At floor locations, sealant bead at top of assembly is adequate.

3.3.11.8. Where necessary, remove insulation from insulated pipe and duct where such services penetrate a fire separation unless certified assembly permits such insulation to remain within assembly. Apply wrapping materials as listed herein.

3.3.11.9. Install System 3 materials at open wall joints, including expansion joints between fire rated enclosures and assemblies.

3.3.12. Systems 4 and 4A: Install at following locations:

3.3.12.1. At electrical, electrical switchgear, electrical transformer rooms and at telephone equipment rooms requiring re-entry for additional services.

3.3.12.2. Install at communications and computer cable penetration points throughout.

3.3.13. Accessories: At hollow fire-rated walls, apply intumescent pads to back surfaces and cable entry points of electrical boxes, panels and other service penetration points, ensuring close coordination with electrical, mechanical and drywall trades. Where greater dimension of panel exceeds 500 mm (20"), gypsum board trades construct fire-rated enclosure around recessed panels.

3.3.14. System 5: Maintain maximum cavity wall compartments to lesser of following 2 criteria by bridging gap between cavity back-up material and back face of brick with full-depth strips of compartment closer and firestopping material, securing in position with mechanical fasteners and sealing against firm, primary cavity materials:

3.3.14.1. 10 m^2 (100 sq ft).

3.3.14.2. Division B, Part 3, Paragraph 3.1.11 of OBC.

3.3.15. Penetration Sizing: Ensure following regulates sizing of service penetrations to be firestopped, other

than for fire dampered openings:

3.3.15.1. Ensure single, circular penetration is sleeved by work of Divisions 21, 22, 23, 26, and 27.

3.3.15.2. Multiple penetrations of circular elements are defined as more than 1 circular penetration having a maximum space of 100 mm (4") between closest faces of such penetrating elements. Forming of multiple penetrations through fire rated assemblies shall be square or rectangular frame around group of penetrations in which maximum clearance between outer penetration element and face of opening shall be 25 mm (1").

3.3.15.3. Create single and multiple rectangular penetrations in same manner as specified above, but edge clearance may be increased to a maximum of 50 mm (2").

3.3.15.4. Exception; at fire dampers, clearances are governed by Newmarket building inspectors.

3.3.15.5. For purposes of this specification, a moving penetrant is defined as a penetrating device having an anticipated movement of greater than 9 mm (3/8") when measured at right angles to face of rated assembly.

3.3.16. Cable Tray Penetrations:

3.3.16.1. Seal cable tray penetrations with re-enterable matrices having a minimum compressive strength of 250 psi having a minimum FTH Rating of 1/2 hr for 500 MCM cables and 2 hr for 300 MCM cables.

3.3.16.2. Ensure listings are for cable tray tests carried out having maximum percentage listed by ULC and/or UL of cable density.

3.4. SITE QUALITY CONTROL

3.4.1. Site Testing and Inspections:

3.4.1.1. Perform a series of 5 fog tests to random locations as designated by the Consultant. Should any penetration, joint or void, under jurisdiction of this Section, emit visible fog, make repairs and replace deficiencies and re-perform fog test at no additional cost to the Owner.

3.4.1.2. Ensure fog units (machines) have a formulation output range of (1.5 gal/hr). Formulation particle size 0.5 - 25 µm. Ensure fogging agent is non-toxic, non-staining and provides a heavy fog at 30 ppm with a permissible airborne level concentration of 50 ppm.

3.4.1.3. Fog at a rate of 4 s/100 cu ft. Maintain fog density until inspection is complete.

3.4.1.4. Independent inspection and testing company may be appointed and paid for by the Owner to carry out additional inspection and testing as directed by the Consultant. Refer to Section 01 40 00 – Quality Requirements. Tests include 3 fog tests per floor at random locations.

3.4.1.5. Where Work or materials fail to meet requirements as indicated by test results, pay costs of additional inspection and testing required for new replacement work or materials.

3.4.2. Ensure firestopping systems do not affect structural integrity of load bearing walls and assemblies. Coordinate with the Consultant prior to penetrating any load bearing assembly. For unusual firestop application for which no tested system is available, ensure manufacturers submit their proposal to local Authorities Having Jurisdiction for their review and approval prior to installation.

3.4.3. Ensure all Work of this Section is by 1 Subcontractor responsible for firestopping materials and systems except as specified herein.

3.4.4. Conform to both temperature and flame ratings of standards listed hereinafter and other requirements of Authorities Having Jurisdiction.

3.4.5. Manufacturer Services: Consult with the Product manufacturer's technical representative about following items:

3.4.5.1. fire stopping system for fire separation required.

3.4.5.2. curing characteristics of materials specified

3.4.5.3. joint characteristics as built.

3.5. CLEANING

3.5.1. Remove excess materials and debris and clean adjacent surfaces immediately after application to satisfaction of the Consultant. Remove and or correct staining and discolouring of adjacent surfaces as directed.

3.5.2. Remove temporary dams after initial set of firestopping and smoke seal materials where such materials are left exposed in finished areas and flame spread rating of such materials exceed a value of 25, in accordance with CAN/ULC-S102.

3.6. PROTECTION

3.6.1. Fully protect walls, windows, floors and other surfaces around areas to be firestopped from marring or damage. Mask where necessary to avoid spillage on to adjoining surfaces. Mask areas adjacent to openings, where necessary to prevent contamination or marring of adjacent surface materials. Remove masking after seal has been completed and an initial set has been achieved. Remove stains on adjacent surfaces as required.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this Section.

1.2. SUMMARY

1.2.1. Section Includes: Provide joints sealants including but not limited to the following:

1.2.1.1. Interior:

1.2.1.1.1. control and expansion joints on exposed interior surfaces of exterior walls.

1.2.1.1.2. perimeter joints of exterior openings where indicated.

1.2.1.1.3. tile control and expansion joints.

1.2.1.1.4. joints between different materials listed above.

1.2.1.1.5. perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.

1.2.1.1.6. joints between plumbing fixtures and adjoining walls, floors and counters.

1.2.1.1.7. other joints as indicated.

1.2.1.2. mildew resistant sealants.

1.2.1.3. self leveling sealants.

1.2.1.4. pick proof sealants.

1.2.2. Related Sections: Following description of Work is included for reference only and shall not be presumed complete:

1.2.2.1. Firestopping and smoke seals: Section 07 84 00 - Firestopping and Smoke Seals.

1.2.2.2. Sealing of joints around sound attenuating gypsum board partitions: Section 09 21 16 - Gypsum Board.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. IPA: Isopropyl Alcohol.

1.3.1.2. MEK: Methyl-ethyl-ketone.

1.3.1.3. MSDS: Material Safety Data Sheets.

1.3.1.4. SCAQMD: South Coast Air Quality Management District; www.aqmd.gov.

1.3.1.5. SWRI: Sealant, Waterproofing, & Restoration Institute; www.swrionline.org.

1.3.1.6. VOC: Volatile Organic Compound.

1.3.2. Reference Standards:

1.3.2.1.	ASTM C661-06	- Standard Test Method for Indentation Hardness of Elastomeric-Type Sealant by Means of a Durometer
1.3.2.2.	ASTM C719-93(05)	- Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
1.3.2.3.	ASTM C834-05	- Standard Specification for Latex Sealants
1.3.2.4.	ASTM C920-08	- Standard Specification for Elastomeric Joint Sealants
1.3.2.5.	ASTM C1021-08	- Standard Practice for Laboratories Engaged in Testing of Building Sealants
1.3.2.6.	ASTM C1248-08	- Standard Test Method for Staining of Porous Substrate by Joint Sealants

1.4. SUBMITTALS

1.4.1. Product Data: Submit Product information from sealant manufacturer to Consultant prior to commencement of the Work of this Section verifying:

1.4.1.1. selected sealant materials are from those specified.

1.4.1.2. composition and physical characteristics.

1.4.1.3. surface preparation requirements.

1.4.1.4. priming and application procedures.

1.4.1.5. suitability of sealants for purposes intended and joint design.

1.4.1.6. test report on adhesion, compatibility and staining effect on samples of adjacent materials used on project.

1.4.1.7. sealants compatibility with other materials and Products with which they come in contact including but not limited to sealants provided under other Sections, insulation adhesives, bitumens, brick, stone, concrete, masonry, metals and metal finishes, ceramic tile, plastic laminates and paints.

1.4.1.8. suitability of sealants for temperature and humidity conditions at time of application.

1.4.2. Test and Evaluation Reports:

1.4.2.1. Compatibility Testing Report: Submit in accordance with Section 01 30 00 – Administrative Requirements. Prior to supply or installation, test exterior sealant materials for compatibility with joint substrates. Test for staining and adhesion including substrates treated with sealers, curing compounds and water repellants etc. Submit a written report of test results to the Consultant.

1.4.2.2. Colour: Submit colours for acceptance in accordance with following general colour hierarchy i.e. Between 2 dissimilar materials, colour the sealant to match the material with the higher relative position on the colour hierarchy scale (highest is at ".1"):

1.4.2.2.1. concrete.

1.4.2.2.2. masonry.

1.4.2.2.3. metal extrusions.

1.4.2.2.4. metal (formed).

1.4.3. Samples: Submit samples in accordance with Section 01 30 00 – Administrative Requirements. Provide cured, colour samples of manufacturer's standard range of colours in each type of sealant and caulking compound for colour selection by the Consultant. Submit samples of primer, bond breaker tape and joint backing material, if requested by the Consultant.

1.5. QUALITY ASSURANCE

1.5.1. Qualifications:

1.5.1.1. Installers: Provide the Work of this Section executed by competent installers who have a membership in good standing with SWRI and have a minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

1.5.1.2. Testing Agencies: An independent testing agency qualified according to ASTM C1021 to conduct testing indicated. Ensure Products are verified by SWRI in accordance with ASTM C719 and ASTM C661.

1.5.2. Preconstruction Testing:

1.5.2.1. Test for compatibility of sealant and accessory Products with joint substrates. Provide test results and written recommendations to the Consultant for primers and substrate preparation required for proper adhesion. For materials failing tests, obtain joint sealant manufacturer's written instructions for corrective measures, including use of specialty formulated primers.

1.5.2.2. Test elastomeric joint sealants for compliance with requirements of ASTM C920 and where applicable, to other standard test methods.

1.5.2.3. Test elastomeric joint sealants for compliance with requirements of ASTM C719 for adhesion and cohesion under cyclic movement, adhesion-in peel and indentation hardness.

1.5.2.4. Test other joint sealants for compliance with requirements indicated by referencing standard Specifications and test methods.

1.5.3. Include lists of completed projects with Name of Consultants and contact persons.

1.6. DELIVERY, STORAGE AND HANDLING

1.6.1. Delivery and Acceptance Requirements: Deliver caulking and sealant materials to the Site in original, unopened containers with manufacturers' labels and seals intact. Labels to identify manufacturer's name, brand name of Product, grade and type, application directions and shelf life or expiry date of Product.

1.6.2. Storage and Handling Requirements:

1.6.2.1. Handle and store materials in accordance with the manufacturer's printed directions. Store flammable materials in safe, approved containers to eliminate fire hazards.

1.6.2.2. Do not use caulking and sealant materials that have been stored for period of time exceeding maximum recommended shelf life of materials.

1.7. SITE CONDITIONS

1.7.1. Ambient Conditions:

1.7.1.1. Do not apply any sealant under adverse weather conditions, when joints to be sealed are damp, wet or frozen or when at ambient temperatures below 5 deg C (40 deg F). Maintain minimum temperature of application during application and for 8 hours after application. Consult manufacturer for specific instructions before proceeding and obtain the Consultant's approval.

1.7.1.2. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated and until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8. WARRANTY

1.8.1. Manufacturer Warranty: Warrant work of this Section for period of 20 years for silicone type sealants and 5 years for other sealants against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to; cracking, crumbling, melting, shrinkage, sag, failure of 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.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

2.1.1.1. ChemRex Inc.; www.chemrex.com

2.1.1.2. CPD Construction Products; www.cpd.com

2.1.1.3. Dow Corning; www.dowcorning.com

2.1.1.4. Euclid Chemical Canada Ltd.; www.euclidchemical.com

2.1.1.5. Momentive Performance Materials; www.momentive.com

2.1.1.6. Sika Canada Inc.; www.sika.ca

2.1.1.7. Tremco Canada; www.tremcosealants.com

2.1.1.8. W.R. Meadows of Canada; www.wrmeadows.com

2.1.1.9 Or Equivalent

2.2. MATERIALS

2.2.1. Description:

2.2.1.1. Regulatory Requirements: Provide a Pre-Start Health and Safety Review in accordance with the *Occupational Health and Safety Act,* R.S.O. 1990, c. O.1Regulation 851, Industrial Establishments as amended. Refer to Section 01 40 00 – Quality Requirement for further requirements.

2.2.2. Performance/Design Criteria: Provide exterior and interior elastomeric joint sealants establishing and maintaining water tight, water resistant and air tight continuous joint seals without staining or deteriorating joint substrates.

2.2.3. General: Ensure elastomeric sealants comply with standards specified in this Section for type, grade, class and uses.

2.2.4. Provide Products with capability, when tested for adhesion and cohesion under maximum cyclic movement in accordance with ASTM C719, to withstand required percentage change in joint width existing at time of installation and remain in compliance with other requirements of ASTM C920 for uses indicated.

2.2.5. Where elastomeric sealants shall be non-staining to porous substrates, provide Products that have undergone testing according to ASTM C1248 and have not stained porous joint substrates indicated for the project.

2.2.6. Type B Sealant: Non-sag type, 1 component, mildew resistant silicone containing non-toxic fungicidal agents sealant conforming to ASTM C920, Type S, Grade NS, Class 25, Use NT. Supply in standard colours as selected by the Consultant. Supply 1 of following:

2.2.6.1. “Dow Corning 786" by Dow Corning.

2.2.6.2. “Trade Mate Tub, Tile & Ceramic Silicone Sealant” by Dow Corning.

2.2.6.3. “GE Sanitary SCS1700" by Momentive Performance Materials.

2.2.6.4. “Tremsil 200, white or clear" by Tremco Canada.

2.2.6.5 Or Equivalent

2.2.7. Type C Sealant: Provide 1 of the following:

2.2.7.1. Non-sag type, 1 component, acrylic latex sealant conforming to ASTM C834, Type OP, Grade -18°C. Supply in standard colours as selected by the Consultant. Supply 1 of following:

2.2.7.1.1. “GE RCS20" by Momentive Performance Materials.

2.2.7.1.2. “Sonolac” by Sonneborn.

2.2.7.1.3. “Tremflex 834" by Tremco Canada.

2.2.7.1.4 Or Equivalent

2.2.7.2. Non-sag type, multi-component polyurethane sealant conforming to ASTM C920, Type M, Grade NS, Class 50, Use T, I, M, A and O. Supply in standard colours as selected by the Consultant. Supply
1 of the following:

2.2.7.2.1. “Sonoplastic NP 2" by ChemRex Inc.

2.2.7.2.2. “Eucolastic II” by Euclid Chemical Canada Ltd.

2.2.7.2.3. “Sikaflex -2c NS” by Sika Canada Inc.

2.2.7.2.4. “DYmeric 240” by Tremco Canada.

2.2.7.2.5 Or Equivalent

2.2.7.3. Non-sag type, 1 component polyurethane sealant conforming to ASTM C920, Type S, Grade NS, Class 25, Use NT, M, A and O. Supply in standard colours as selected by the Consultant. Supply 1 of the following:

2.2.7.3.1. “Sonoplastic NP1" by ChemRex Inc.

2.2.7.3.2. “Sikaflex -1a” by Sika Canada Inc.

2.2.7.3.3. “DyMonic” and/or “Vulkem 116" by Tremco Canada.

2.2.7.3.4 Or Equivalent

2.2.8. Type D Sealant: Provide 1 of following:

2.2.8.1. Pour grade, 1 component polyurethane sealant conforming to ASTM C920, Type S, Grade P, Class 25, Use T, M, A, I and O. Supply in standard colours as selected the Consultant. Supply 1 of following:

2.2.8.1.1. “SL 1" by ChemRex Inc.

2.2.8.1.2. “Sikaflex Self Levelling Sealant” by Sika Canada Inc.

2.2.8.1.3. “Vulkem 45” by Tremco Canada.

2.2.8.1.4 Or Equivalent

2.2.8.2. Pour grade, multi-component, polyurethane sealant conforming to ASTM C920, Type M, Grade P, Class 25, Use T, M, A, I and O. Supply 1 of following:

2.2.8.2.1. “NP 2" by ChemRex Inc.

2.2.8.2.2. “Sikaflex 2c SL” by Sika Canada Inc.

2.2.8.2.3. “THC-900/901 or Vulkem 245" by Tremco Canada.

2.2.8.2.4. Or Equivalent

2.2.8.3. Pour grade, 1 component ultra-low modulus, pre-pigmented, neutral cure elastomeric silicone sealant. Supply in standard colours as selected by the Consultant. Supply 1 of the following:

2.2.8.3.1. “Dow Corning SL Parking Structure Sealant (Self Leveling)” by Dow Corning.

2.2.8.3.2. “GE Tosseal* 817” by Momentive Performance Materials.

2.2.8.3.3. “Spectrum 900SL Self Leveling Silicone Highway and Parking Structure Sealant” by Tremco Canada.

2.2.8.3.4. Or Equivalent

2.2.8.4. Non-sag type, 1 component low-modulus, pre-pigmented, neutral cure elastomeric silicone sealant conforming to ASTM C920, Type S, Grade NS, Class 50, Use NT, G, M, A and O. Supply in standard colours as selected by the Consultant. Supply 1 of following:

2.2.8.4.1. “Dow Corning Contractors Concrete Sealant (CCS)” by Dow Corning.

2.2.8.4.2. “Dow Corning NS Parking Structure Sealant (Non-Sag)” by Dow Corning.

2.2.8.4.3. "GE Tosseal* 811" by Momentive Performance Materials.

2.2.8.4.4. "Spectrum 800 Low Modulus Silicone Highway and Parking Structure Sealant" by Tremco Canada.

2.2.8.4.5. Or Equivalent

2.2.9. Type E Sealant: Self-levelling type, epoxy modified joint sealant, cold-applied, 2 component, pour grade, grey colour. Supply 1 of following:

2.2.9.1. "EP 280 Control Joint Sealant" by ChemRex Inc.

2.2.9.2. "CPD Joint-Flex P.E." by CPD Construction Products.

2.2.9.3. "Loadflex" by Sika Canada Inc.

2.2.9.4. "Rezi-Weld™ Flex" by W.R. Meadows of Canada.

2.2.9.5. "Foil-fast Epoxy Injection Gel" by The RawPlug Co. Inc.

2.2.9.6. Or Equivalent

2.2.10. Joint Primer: Non-staining, suitable for substrate surfaces, compatible with joint forming materials and as recommended by sealant manufacturer for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

2.2.11. Joint Backing: Preformed, compressible, resilient, non-waxing, non-extruding, non-staining strips of closed cell polyethylene or urethane foam, compatible with joint substrates and are approved by sealant manufacturer based on field experience and laboratory test. Sizes and shapes to suit various conditions, diameter 25% greater than joint width. Ensure backing is compatible with sealant, primer and substrate.

2.2.12. Bond Breaker Tape: As recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.2.13. Masking Tape: Provide non-staining, non-absorbent tapes and sheets which effectively mask substrate without leaving an adhesive residue compatible with joint sealants and surfaces adjacent to joints.

2.2.14. Cleaning Material: Non-corrosive, non-staining, solvent type, xylol, MEK, toluol, IPA or as recommended by sealant manufacturer and acceptable to material or finish manufacturers for surfaces adjacent to sealed areas free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants with joint substrates.

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions:

3.1.1.1. Examine joints for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealant performance. Ensure joints are suitable to accept and receive sealants.

3.1.1.2. Verify joint surfaces are clean, sound, free of defects and dimensions are within sealant manufacturer's size requirements.

3.1.1.3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.1.1.4. Do not apply sealant to masonry until mortar has cured.

3.1.2. Pre-installation Testing: Before any sealing Work is commenced, test materials for indications of staining or poor adhesion.

3.1.3. Evaluation and Assessment: Commencement of Work implies acceptance of previously completed work.

3.2. PREPARATION

3.2.1. Protection of In-Place Conditions: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2.2. Surface Preparation:

3.2.2.1. Clean joints and spaces which are to be sealed and ensure they are dry and free of dust, loose mortar, oil, grease, oxidation, coatings, form release agents, sealers and other foreign material.

3.2.2.2. Clean porous surfaces such as concrete, masonry or stone by wire brushing, grinding or blast cleaning, mechanical abrading or combination of these methods as required to obtain clean and sound surfaces.

3.2.2.3. Remove laitance by grinding or mechanical abrading.

3.2.2.4. Remove oils by sandblast cleaning.

3.2.2.5. Remove loose particles present or resulting from grinding, abrading or sandblast cleaning by thorough brushing.

3.2.2.6. Clean ferrous metals of rust, mill scale and foreign materials by wire brushing, grinding or sanding.

3.2.2.7. Wipe non-porous surfaces such as metal and glass to be sealed, except pre-coated metals, with cellulose sponges or clean rags soaked with ethyl alcohol, ketone solvent, xylol or toluol and wipe dry with clean cloth. Where joints are to be sealed with silicone based sealants clean joint with MEK or xylol. Do not allow solvent to air-dry without wiping. Clean pre-coated metals with solutions or compounds which will not injure finish and which are compatible with joint primer and sealant. Check ferrous metal surfaces are painted before applying sealant.

3.2.2.8. Examine joint sizes and where depth of joint exceed required depth of sealant correct to achieve proper following width/depth ratio:

3.2.2.8.1. Maintain 2:1 Width/Depth Ratio: Ensure maximum sealant depth is 13 mm (1/2) and minimum contact width with each substrate is 6 mm (1/4").

3.2.2.9. Install joint backing material to achieve correct, uniform joint profile and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

3.2.2.10. Do not leave gap between ends of sealant backing; do not stretch, twist, puncture, or tear sealant backings; remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

3.2.2.11. Where joint design or depth of joint prevents use of joint backing material, apply bond breaker tape at back of joint to prevent 3-sided adhesion.

3.2.2.12. Do not stretch, twist, puncture or tear joint backing. Butt joint backing at intersections. Install bond breaker tape at back of joint where joint backing is not required or cannot be installed.

3.2.2.13. On horizontal traffic surfaces, support joint filler against vertical movement which might result from traffic loads, including foot traffic.

3.2.2.14. Where surfaces adjacent to joints are likely to become coated with sealant during application, mask them prior to priming and sealing.

3.2.2.15. Do not exceed shelf life and pot life of materials and installation times, as stated by manufacturer.

3.2.2.16. Be familiar with work life of sealant to be used. Do not mix multiple component materials until required for use.

3.2.2.17. Use materials as received from manufacturer, without additions, deletions and adulterations of materials.

3.2.2.18. Mix multiple component sealants and bulks sealants using mechanical mixer capable of mixing without mixing air into material, in accordance with manufacturer's directions and recommendations. Continue mixing until material is homogeneously blended, uniform in colour and free from streaks of unmixed material. Install compound prior to start of hardening or curing cycle.

3.2.2.19. Prior to painting, seal joints in surfaces to be painted. Where surfaces to be sealed are prime painted in shop before sealing ensure prime paint is compatible with primer and sealant. If they are incompatible, inform Consultant and change primer and sealant to compatible types approved by Consultant.

3.2.2.20. Where irregular surface or sensitive joint border exists, apply masking tape at edge of joint to ensure joint neatness and protection.

3.2.2.21. Prime sides of joints for type of surface being sealed prior to application of joint backing, bond breaker or sealant as recommended by sealant manufacturer.

3.2.3. Removal:

3.2.3.1. Remove existing caulking and/or sealant from joints, as required.

3.2.3.2. Remove existing caulking and/or sealants including any residual caulking/sealant material using suitable methods to prevent damage to adjacent surfaces. Take care to ensure no damage or visible changes take place to surface of substrate that will not be covered by replacement sealant material.

3.2.3.3. Clean surfaces of joints and spaces in accordance with procedures specified herein under "Surface Preparation".

3.2.3.4. Ensure materials in contact with sealant are compatible.

3.2.3.5. Where required, mask adjacent surfaces prior to priming and application of sealant to prevent staining.

3.2.3.6. Prime inner surfaces of joint, where required, immediately prior to caulking, in accordance with sealant manufacturer's recommendations, to provide full adhesion and to prevent staining of adjacent exposed surfaces.

3.3. APPLICATION

3.3.1. Apply in accordance with the manufacturer's directions and recommendations unless more stringent requirements apply.

3.3.2. Apply sealant by proven techniques using hand operated guns or pressure equipment fitted with suitable nozzle size and equipment approved by sealant manufacturer.

3.3.3. Force sealant into joint and against sides of joints to obtain uniform adhesion. Use sufficient pressure to completely fill voids in joint regardless of variation in joint widths and to proper joint depth as prepared. Ensure full firm contact with interfaces of joint. Superficial pointing with skin bead is not acceptable.

3.3.4. Finish face of compound to form smooth, uniform beads. At recesses in angular surfaces, finish compound with flat face, flush with face of materials at each side. At recesses in flush surfaces, finish compound with concave face flush with face of materials at each side.

3.3.5. Compound may be tooled, provided such tooling does not damage seal or tear compound. Avoid pulling of sealant from sides.

3.3.6. Tool surfaces as soon as possible after sealant application or before any skin formation has occurred, particularly when using silicone sealants.

3.3.7. Ensure joint surfaces are straight, neatly finished, free from ridges, wrinkles, sags, dirt, stains, air pockets and embedded foreign matter or other defacement and be uniform in colour, free from marbling and/or colour streaking due to improper mixing or use of out of shelf life Products.

3.3.8. Do not use solvent curing sealants indoors.

3.3.9. Use 1 of sealants specified for each type in following locations. Ensure sealant chosen (from several specified under each type under "MATERIALS") for each location is recommended by manufacturer for use for conditions encountered:

3.3.9.1. Type A: Typically used in joints between metal frames and adjacent masonry and/or concrete construction in exterior walls, exterior and interior sides; control and expansion joints in exterior and interior surfaces of poured-in-place concrete walls, precast architectural wall panels and unit masonry walls; sealing of joints between underside of pre-stressed precast concrete floor slabs and masonry; and other locations where sealant is required or noted on Drawings except in locations designated for Type B, C, D, E, F and G and except where sealant is specified in other Sections.

3.3.9.2. Type B: Typically used in joints between urinals and walls, around washrooms accessories, at corners of walls, between splash backs and walls, in shower, damp or wet areas, at ceramic tiles where mildew resistant sealant is required.

3.3.9.3. Type C: Typically used in joints between interior metal and/or wood frames and adjacent construction in interior partitions.

3.3.9.4. Type E (load bearing): Typically used in static joints in horizontal surfaces where self-levelling sealants are required.

3.3.10. Joint designation in preceding paragraphs and fact that Drawings do not show all locations to be sealed does not limit responsibility of this Section to seal all locations except those indicated in other Sections of Work, required to create and ensure continuous enclosure.

3.3.11. Firestopping and Smoke Seal: Sealants part of firestopping systems and smoke seals provided within fire rated assemblies are part of work of Section 07 84 00 - Firestopping and Smoke Seals and carried out under supervision of this Section.

3.4. REPAIR

3.4.1. Repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original Work.

3.5. SITE QUALITY CONTROL

3.5.1. Site Tests and Inspections:

3.5.1.1. Independent inspection and testing company may be appointed and paid for under the Cash Allowance listed in the Bid Form as Item No. 4 – Inspection and Testing to carry out inspection and testing as directed by Consultant. Refer to Section 01 40 00.

3.5.1.2. Inspect joints for complete fill, for absence of voids and for joint configuration complying with specified requirements. Record results in a manner acceptable to the Consultant.

3.5.1.3. Tests may include sampling of installed Product where adhesion, cohesion or reversion failure is suspected.

3.5.1.4. Where Work or materials fail to meet requirements as indicated by test results, pay costs of additional inspection and testing required for new replacement work or materials.

3.5.2. Non-Conforming Work: Replace damaged Work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of the Consultant at no cost to the Owner.

3.5.3. Manufacturer Services:

3.5.3.1. Prior to commencement of sealing, arrange for sealant manufacturer's technical representative to visit the Place of the Work and inspect surfaces and joints to be sealed.

3.6. CLEANING

3.6.1. Immediately clean adjacent surfaces which have been soiled and leave work in neat, clean condition. Remove excess materials, compounds smears or other soiling resulting from application of sealants. Use recommended cleaners and solvents as provided by the product manufacturers. Leave finished Work in neat, clean condition with no evidence of spillovers onto adjacent surfaces.

3.7. PROTECTION

3.7.1. Provide approved, non-staining means of protection for completed joint sealant installations where required to protect work from mechanical, thermal, chemical and other damage by construction operations and traffic.

3.7.2. Maintain protection securely in place until completion of Work. Remove protection when so directed by the Consultant.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to with the Contract Documents including Division 1 requirements and documents referred to in this Section.

1.2. SUMMARY

1.2.1. Section Includes: Provide steel doors and frames including but not limited to following:

1.2.1.1. supply of hollow metal door frames.

1.2.1.2. supply of hollow metal transom panels.

1.2.1.3. supply of hollow metal frames and mullions for borrowed lights and glazed screens.

1.2.1.4. preparation of hollow metal doors and frames for finish hardware.

1.2.1.5. glazing stops.

1.2.2. Related Sections: t h e following description of Work is included for reference only and shall not be presumed complete:

1.2.2.1. Hanging door and installation of finish hardware: Section 06 90 00 - General Installations.

1.2.2.2. Caulking and/or sealing door frames: Section 07 92 00 - Joint Sealants.

1.2.2.3. Supply of finish hardware: Section 08 71 00 - Finish Hardware.

1.2.2.4. Provision of glazing: Section 08 80 00 - Glass and Glazing.

1.2.2.5. Finish painting: Section 09 91 00 - Painting.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. CSDMA: Canadian Steel Door Manufacturers Association; www.csdma.org.

1.3.1.2. OBC: Ontario Building Code, 2006.

1.3.1.3. PVC: Polyvinyl-Chloride.

1.3.1.4. RRPC: Resin Reinforced Polychloroprene.

1.3.1.5. STC: Sound Transmission Class.

1.3.1.6. TL: Transmission Loss.

1.3.1.7. TRR: Temperature Rated Rise.

1.3.1.8. ULC: Underwriters' Laboratories of Canada; www.ulc.ca.

1.3.2. Reference Standards:

1.3.2.1.	ANSI A115.IG-94	- Installation Guide for Doors and Hardware
1.3.2.2.	ANSI A224.1-94	- Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames

1.3.2.3.	ANSI A250.4-94	- Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings
1.3.2.4.	ASTM A568/A568M-07a	- Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
1.3.2.5.	ASTM A653/A653M-08	- Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
1.3.2.6.	ASTM C177-04	- Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
1.3.2.7.	ASTM C518-04	- Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
1.3.2.8.	ASTM E90-04	- Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
1.3.2.9.	ASTM E413-04	- Classification for Rating Sound Insulation
1.3.2.10.	CGSB 41-GP-19Ma	- Rigid Vinyl Extrusions for Windows and Doors
1.3.2.11.	CAN/CGSB-82.5-M88	- Insulated Steel Doors
1.3.2.12.	CSA W59-03(08)	- Welded Steel Construction (Metal Arc Welding)
1.3.2.13.	NAAMM-HMMA 840-07	- Guide Specification for Installation of Hollow Metal Doors and Frames
1.3.2.14.	NFPA 80-07	- Standard for Fire Doors and Fire Windows
1.3.2.15.	NFPA 252-08	- Standard for Fire Tests of Door Assemblies
1.3.2.16.	NFPA 257-07	- Standard for Fire Tests of Window Assemblies and Glass Block Assemblies
1.3.2.17.	CAN4-S104-M80(85)	- Standard Method for Fire Tests of Door Assemblies
1.3.2.18.	CAN4-S105-M85(92)	- Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104
1.3.2.19.	CAN4-S106-M80(85)	- Standard Method for Fire Test of Window and Glass Block Assemblies
1.3.2.20.	CAN/ULC-S702-97	- Standard for Mineral Fibre Thermal Insulation for Buildings

1.4. ADMINISTRATIVE REQUIREMENTS

1.4.1. Scheduling: Submit a schedule indicating each frame related to the doors and frames shown on the Drawings.

1.5. SUBMITTALS

1.5.1. Shop Drawings: Submit Shop Drawings in accordance with Section 01 30 00 – Administrative Requirements. Show each type of frame, metal thicknesses and finishes, openings (glazed and/or louvred), fire ratings, location of exposed fasteners, cutouts, hardware blanking, reinforcing, tapping and drilling arrangements. Show large scale frame sections and anchoring details. Submit door and frame schedule identifying each unit. Ensure each unit bears legible identifying mark corresponding to that listed in the Door and Frame Schedule.

1.5.2. Samples: Submit samples in accordance with Section 01 30 00 – Administrative Requirements. Provide 1 cut-away corner sample minimum 300 mm (12") square for each type of door to indicated following:

1.5.2.1. frame.

1.6. QUALITY ASSURANCE

1.6.1. Qualifications:

1.6.1.1. Manufacturers: Execute the work of this Section by a manufacturer who is a member of CSDMA.

1.7. DELIVERY, STORAGE AND HANDLING

1.7.1. Delivery and Acceptance Requirements:

1.7.1.1. Protect frames during shipping.

1.7.1.2. Note damage incurred during shipping.

1.7.2. Storage and Handling Requirements:

1.7.2.1. Protect doors and frames during storage.

1.7.2.2. Store and protect materials in accordance with NAAMM-HMMA 840. Coordinate this requirement with Section 06 90 00 – General Installations for installing doors.

1.7.2.3. Remove wrappings or coverings from doors upon delivery at site. Store doors in vertical position, spaced by blocking to permit air circulation between them.

1.8. WARRANTY

1.8.1. Manufacturer Warranty: Warrant work manufactured from ASTM A653/A653M, A40 galvannealed steel, touched up only with zinc-rich rust inhibitive primer where coating was removed during its manufacture for period of 10 years against defects and/or deficiencies in accordance with the General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within the warranty period, to satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to; rust perforation when stored, installed and finish painted in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, schedules and Specifications:

2.1.1.1. Ali-Porte Inc.; www.aliporte.com

2.1.1.2. Artek Door Limited; www.artekdoor.com

2.1.1.3. Baron Metal; www.baronmetal.com

2.1.1.4. Daybar Industries Limited; www.daybar.com

2.1.1.5. Fleming Door Products Ltd.; www.flemingdoor.com

2.1.1.6. Metal Door Ltd.; www.metaldoorltd.com

2.1.1.7 Or Equivalent

2.2. MATERIALS

2.2.1. Description:

2.2.1.1. Regulatory Requirements: Provide a Pre-Start Health and Safety Review in accordance with the *Occupational Health and Safety Act,* R.S.O. 1990, c. O.1Regulation 851, Industrial Establishments, as amended. Refer to Section 01 40 00 – Quality Requirements for further requirements.

2.2.1.2. Ensure Product quality meets standards set by CSDMA.

2.2.2. Sheet Steel: Commercial grade steel to ASTM A568/A568M, Class 1, hot-dip galvanized to ASTM A653/A653M, ZF120 (A40), known commercially as "Colourbond", "Satincoat", or "Galvanneal". Steel sheet thicknesses specified are base metal thicknesses prior to galvanizing.

2.2.3. Frame Anchors:

2.2.3.1. Floor Anchors: Minimum 3 mm (1/8") thick adjustable base anchors with 2 holes for bolting to floor.

2.2.3.2. Wall Anchors:

2.2.3.2.1. Masonry T-strap Type Wall Anchors: Minimum 1.2 mm thick (18 ga) steel

2.2.3.2.2. Existing Masonry/Concrete Wall Type Anchors: Minimum 0.912 mm thick (20 ga) steel.

2.2.3.2.3. Masonry Stirrup-strap Type 50 mm x 250 mm (2" x 10"): Minimum 1.519 mm thick (16 ga) steel.

2.2.3.2.4. Steel/Wood Stud Type: Minimum 0.912 mm thick (20 ga) steel.

2.2.3.2.5. Steel/Wood Stud Tension and Associated Wall Type: Minimum 0.912 mm thick (20 ga) steel.

2.2.4. Fire Rated Door and Frame Assemblies: Conform to CAN4-S104-M, CAN4-S105-M, NFPA 80 and NFPA 252.

2.2.5. Fabrication:

2.2.5.1. Welding: Carry out welding in accordance with CSA W59.

2.2.5.2. Grind exposed welds smooth and flush. Fill open joints, seams and depressions with filler or by continuous brazing or welding. Grind smooth to true sharp arises and profiles and sand down to smooth, true, uniform finish.

2.2.5.3. Hardware Requirements: Blank, mortise, reinforce, drill and tap doors and frames to receive mortised templated hardware. Check hardware list for requirements.

2.2.5.4. Frames - General:

2.2.5.4.1. Fabricate frames for doors, screens and borrowed lights to profiles indicated.

2.2.5.4.2. Reinforce frame as required for surface mounted hardware. For door frames wider than 1500 mm (5'), reinforce door frame head and jamb and mullions at junction of head.

2.2.5.4.3. Protect mortise cut outs with mortar guard boxes. Omit for gypsum board applications.

2.2.5.4.4. Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb. Provide 2 anchors for rebate opening heights up to and including 1500 mm (5') and 1 additional anchor for each additional 760 mm (30") of height or fraction thereof, except as indicated below. For frames in previously placed concrete, masonry or structural steel provide anchors located not more than 150 mm (6") from top and bottom of each jamb and intermediate anchors at 660 mm (26") on centre maximum.

2.2.5.4.5. Where floor finishes allow, fabricate frames to extend 38 mm (1-1/2") below finished floor level. Where frames are to terminate at finished floor level, provide plates for anchorage to slabs.

2.2.5.4.6. Prepare each door opening for single stud door silencers: 3 for single door openings placed opposite hinges: 2 for double door openings approximately 150 mm (6") each side of centreline of head stop.

2.2.5.4.7. Supply removable portion of stop and frame where required for overhead concealed door closers and properly connect to frame and prepare for attachment to closer prior to shipment.

2.2.5.4.8. Provide 0.912 mm thick (20 ga) steel snap-in or welded-in “Z” type stud anchors for door frames installed in steel stud gypsum board partitions. Ensure snap-in clips are supplied to Section 09 21 16.

2.2.5.4.9. Fabricate thermally broken door frames in accordance with Shop Drawings. Provide wall and floor anchors suitable for installation conditions. Anchoring devices must not permit thermal conductivity from exterior frames to interior frame sections. Provide thermal break to separate interior and exterior frame sections.

2.2.5.4.10. Factory apply touch-up primer to areas where zinc coating has been removed during fabrication.

2.2.5.5. Hollow Metal Door Frames and Transom Frames:

2.2.5.5.1. Steel:

2.2.5.5.1.1. Interior: Minimum 1.519 mm thick (16 ga) steel.

2.2.5.5.2. Reinforcements:

2.2.5.5.2.1. Lock and Strike Reinforcements: Minimum 1.519 mm thick (16 ga) steel.

2.2.5.5.2.2. Hinge Reinforcements: Minimum 3.4 mm thick (10 ga) steel.

2.2.5.5.2.3. Flush Bolt Reinforcement: Minimum 1.519 mm thick (16 ga) steel.

2.2.5.5.2.4. Reinforcement for Surface Applied Hardware: Minimum 1.2 mm thick (18 ga) steel.

2.2.5.5.2.5. Concealed Door Closer or Holder Reinforcements: Minimum 2.6 mm thick (12 ga) steel.

2.2.5.5.2.6. Top and Bottom End Channels: Minimum 1.2 mm thick (18 ga) steel.

2.2.5.5.3. Jamb Spreaders: Minimum 0.912 mm thick (20 ga) steel.

2.2.5.6. Sidelight and Window Frame Assemblies:

2.2.5.6.1. Steel: Minimum 1.519 mm thick (16 ga) steel.

2.2.5.6.2. Glazing Stops: Minimum 0.912 mm thick (20 ga) steel, formed, drilled and countersunk for fastenings.

2.2.5.7. Welded Type Frames:

2.2.5.7.1. Mitre corners of frames. Cut frame mitres accurately and weld continuously on returns and inside of frame faces.

2.2.5.7.2. When required due to site access or due to shipping limitations, fabricate frame Product for large openings in sections, with splice joints for field assembly. Indicate joints for field assembly on Shop Drawings.

2.2.5.7.3. Accurately cope and securely weld butt joints of mullions, transom bars, centre rails and sills. Grind welded joints to a smooth, uniform finish.

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

2.2.5.7.5. Weld in 2 temporary jamb spreaders at each frame to maintain alignment during shipment.

2.2.5.7.6. Use formed channel glazing stops, minimum 16 mm (5/8") in height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.

2.2.5.8. Prime Painting: Apply factory touch up primer at areas where zinc coating has been damaged during fabrication.

2.3. SOURCE QUALITY CONTROL

2.3.1. Non-Conforming Work: Replace damaged Work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of the Consultant at no cost to the Owner.

PART 3 - EXECUTION

3.1. INSTALLATION

3.1.1. Supply steel frames to Section 06 90 00 – General Installations for installation.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this Section.

1.2. SUMMARY

1.2.1. Section Includes: Provide wood doors including but not limited to following:

1.2.1.1. wood doors.

1.2.1.2. glass stops.

1.2.2. Related Sections: the following description of Work is included for reference only and shall not be presumed complete:

1.2.2.1. Installation of wood doors and finish hardware: Section 06 90 00 - General Installations.

1.2.2.2. Supply steel door frames: Section 08 11 13 - Steel Doors and Frames.

1.2.2.3. Supply of finish hardware: Section 08 71 00 - Finish Hardware.

1.2.2.4. Glazing: Section 08 80 00 - Glass and Glazing.

1.2.2.5. Setting steel door frames in gypsum board partitions: Section 09 21 16 - Gypsum Board.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. AWI/AWMAC/WI: American Woodwork Institute/Architectural Woodwork Manufacturers Association of Canada/Woodwork Institute; www.awmac.com.

1.3.1.2. AWS: Architectural Woodwork Standards, Edition 1, 2009.

1.3.1.3. FSC: Forest Stewardship Council; www.fsccanada.org.

1.3.1.4. HVAC: Heating, Ventilating and Air Conditioning.

1.3.1.5. ITS: (Warnock Hersey) - Certification Listings for Fire Doors.

1.3.1.6. MDO: Medium Density Overlay.

1.3.1.7. MSDS: Material Safety Data Sheets.

1.3.1.8. OBC: Ontario Building Code, 2006.

1.3.1.9. VOC: Volatile Organic Compound.

1.3.2. Reference Standards:

1.3.2.1.	ANSI/WDMA I.S. 1A-04	- Industry Standard for Architectural Flush Wood Doors
1.3.2.2.	ANSI/WDMA I.S. 6A-08	- Industry Standard for Architectural Stile and Rail Doors
1.3.2.3.	ASTM E90-04	- Standard Test Method for Laboratory Measurement of Sound Transmission Loss of Building Partitions
1.3.2.4.	ASTM E413-04	- Classification for Rating Sound Insulation

1.3.2.5.	CAN/CGSB-11.3-M87	- Hardboard
1.3.2.6.	CSA O112 Series-M77	- CSA Standards for Wood Adhesive
1.3.2.7.	CAN4-S104-M80(85)	- Standard Method for Fire Tests of Door Assemblies
1.3.2.8.	CAN4-S113-79(00)	- Standard Specification for Door, Wood Core, Meeting the Performance Required by CAN4-S104 for Twenty Minute Fire Rated Closure Assemblies
1.3.2.9.	NFPA 80-07	- Standard for Fire Doors and Fire Windows
1.3.2.10.	NFPA 252-08	- Standard Methods of Fire Tests of Door Assemblies
1.3.2.11.	UL 10B	- Underwriters Laboratories Fire Tests for Door Assemblies

1.4. SUBMITTALS

1.4.1. Shop Drawings:

1.4.1.1. Submit Shop Drawings in accordance with Section 01 30 00 – Administrative Requirements.

1.4.1.2. Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special bevelling, special blocking for hardware, identify cut outs for glazing and other openings.

1.4.1.3. Submit Product data indicating door core materials and construction and face type wood veneer.

1.4.14. 12”x12” wood veneer sample to be provided to Consultant for approval prior to supply/install

1.5. QUALITY ASSURANCE

1.5.1. Qualifications:

1.5.1.1. Provide the Work of this Section in accordance with Section 9 of AWS produced by AWI/AWMAC/WI, except as specified otherwise herein and by reference are hereby made a part of this Section. Ensure any reference to grades and terminology in this Section is as defined in AWS.

1.5.1.2. Requirements of this Section govern and modify AWS.

1.5.1.3. Installers: Provide the Work of this Section executed by competent installers with a minimum of 5 years’ experience in the application of Products, systems and assemblies specified and be a member of AWI/AWMAC/WI.

1.6. DELIVERY, STORAGE AND HANDLING

1.6.1. Delivery and Acceptance Requirements:

1.6.1.1. Do not subject interior wood doors to extremes in either heat or humidity. Do not accept delivery to the Site until HVAC systems are operational and balanced, providing temperature range of 10 deg C to 32 deg C (50 deg F to 90 deg F) and 25% to 55% relative humidity.

1.6.1.2. Accept doors at the Site in the manufacturer's standard packaging.

1.6.2. Storage and Handling Requirements: Store and protect wood doors in accordance with the manufacturer’s recommendations and ANSI/WDMA I.S. 1A’s Appendix Section “Care and Installation at Job Site”. Ensure Contractor responsible for receiving and storing wood doors has a copy of ANSI/WDMA I.S.1A.

1.7. WARRANTY

1.7.1. Manufacturer Warranty: Warrant the Work of this Section against defects and deficiencies for a period of 2 years as per the General Conditions of the Contract. Promptly correct defects and deficiencies which become apparent during the warranty period, to satisfaction of the Consultant and at no expense to the Owner. Defects include, but are not limited to, bubbling, delamination of faces, or edges, warp, twist bow exceeding 6 mm (1/4") and telegraphing of core. "Correct" referred to herein includes labour and materials for removal, repair, refinishing and replacement of Products provided as part of the Work of this Section, installing hardware, finishing, hanging and fitting.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are acceptable subject to conformance to requirements of the Drawings, Door Schedule and Specifications:

2.1.1.1. Baillargeon; www.baillargeondoors.com

2.1.1.2. Cambridge Door Company Ltd.; www.cambridgedoor.com

2.1.1.3. Graham Door; www.grahamdoors.com

2.1.1.4. JWS Manufacturing Inc.; www.jwsmanufacturing.com

2.1.1.5. Lambton Doors; www.lambtondoors.com

2.1.1.6. Marshfield Door Systems, Inc.; www.marshfielddoors.com

2.1.1.7 Or Equivalent

2.2. MATERIALS

2.2.1. Description:

2.2.1.1. Regulatory Requirements:

2.2.1.1.1. Ensure wood doors comply with AWI/AWMAC/WI, Section 9 or ANSI/WDMA I.S. 1A.

2.2.2. Conform to AWI/AWMAC/WI, Section 9 or ANSI/WDMA I.S. 1A for wood flush doors and AWI/AWMAC/WI, Section 9 or ANSI/WDMA I.S. 6A for stile and rail doors, except as specified herein.

2.2.3. Supply wood doors from same manufacturer.

2.2.4. Solid Wood Core Wood Flush Doors:

2.2.4.1. Construction: 7 ply.

2.2.4.2. Fire Rating: Unrated.

2.2.4.3. Core: Kiln dried soft wood blocks; relative density not less than 0.30 at 12% moisture content; of random lengths placed vertically or horizontally not exceeding 50 mm (2") wide; staggered laminated by heat and pressure.

2.2.4.4. Stiles: Minimum 107 mm (4-3/16") low density laminated wood including a 22 mm (7/8") hardwood to match face.

2.2.4.5. Top and Bottom Rails: Minimum 85 mm (3-5/16") low density laminated wood.

2.2.5. Vision Frames for Unrated Doors: Wood, of same species as door; channel shape; mitre corners; prepared for countersink style screws.

2.2.6. Fabrication:

2.2.6.1. Fabricate flush doors in accordance with AWI/AWMAC/WI, Section 9 or ANSI/WDMA I.S. 1A and CAN4-S113 and stile and rail doors in accordance with AWI/AWMAC/WI, Section 9 or ANSI/WDMA I.S. 1A except as specified herein.

2.2.6.2. Size doors for 3 mm (1/8") clearance of heads and jambs and 9 mm (3/8") at bottom.

2.2.6.3. Bevel vertical edges of single acting doors 3 mm in 50 mm (1/8" in 2") on lock side and 1.5 mm in 50 mm (1/16" in 2") on hinge side.

2.2.6.4. Radius vertical edges of double acting doors to 60 mm (2-3/8") radius.

2.2.6.5. Flush Doors:

2.2.6.5.1. Fabricate solid core doors using hot or cold press construction technology. Bond stiles and rails to core using Type I or II adhesive. Sand for uniform thickness. Laminate door facing, crossbanding and assembled core in hot or cold press.

2.2.6.5.2. Factory cut glass light openings. Ensure openings are square with internal corners slightly rounded. Ensure portion between cutout and door edge is not less than 125 mm (5") wide at any point. Ensure cut out area is not greater than 40% of area of door face. Ensure cut out does not exceed half height of door.

2.2.6.5.3. Provide hardwood glass stops, finished to match face veneer, for vision panels in un-rated doors

2.2.6.5.4. Factory fit doors for frame opening dimensions identified on Shop Drawings.

2.2.6.6. Finish:

2.2.6.6.1 White oak wood veneer finish. Stain grade quality

2.2.6.6.2. Factory finish doors in accordance with AWI/AWMAC/WI, Section 5, System -11, Polyurethane, catalyzed or ANSI/WDMA I.S. 1A, TR-6 & OP-6 Catalyzed Polyurethane; clear coat finish, stain colour and sheen as selected by Consultant.

2.3. SOURCE QUALITY CONTROL

2.3.1. Non-Conforming Work: Replace damaged Work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of the Consultant at no cost to the Owner.

PART 3 - EXECUTION

3.1. INSTALLATION

3.1.1. Installation of wood doors and finish hardware forms part of the Work of Section 06 90 00 – General Installations.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this Section.

1.2. SUMMARY

1.2.1. Section Includes: Supply finish hardware including but not limited to following:

1.2.1.1. pressed steel frames.

1.2.1.2. wood doors.

1.2.2. Related Sections: the following description of work is included for reference only and shall not be presumed complete:

1.2.2.1. Provision of hardware for cabinetry work: Section 06 40 00 - Architectural Woodwork.

1.2.2.2. Installation of finish hardware: Section 06 90 00 - General Installations.

1.2.2.3. Supply of hollow metal doors and frames: Section 08 11 13 - Steel Doors and Frames.

1.2.2.4. Supply of wood doors: Section 08 14 00 - Wood Doors.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. ADA: Americans with Disabilities Act; www.ada.gov.

1.3.1.2. AHC: Architectural Hardware Consultant.

1.3.1.3. BHMA: Builders Hardware Manufacturers Association; www.buildershardware.com.

1.3.1.4. CSA: Canadian Standards Association; www.csa.ca.

1.3.1.5. DHI: Door and Hardware Institute Canada; www.dhicanada.ca.

1.3.1.6. NFPA: National Fire Protection Association; www.nfpa.org.

1.3.1.7. UL: Underwriters' Laboratories Inc.; www.ul.com.

1.3.1.8. ULC: Underwriters' Laboratories of Canada; www.ulc.ca.

1.3.2. Reference Standards:

1.3.2.1. NFPA 80-07 - Standard for Fire Doors and Fire Windows

1.3.2.2. CAN4-S104-M80(85) - Standard Method for Fire Tests of Door Assemblies

1.3.2.3. CAN4-S105-M85(92) - Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104

1.4. SUBMITTALS

1.4.1. Shop Drawings:

1.4.1.1. Submit Shop Drawings for hardware installation in accordance with Section 01 30 00 – Administrative Requirements.

1.4.1.2. Submit Shop Drawings in schedule form, prepared by an AHC, indicating manufacturers' names, Product descriptions, makes, models, materials, finishes, functions, location of each item, complete keying schedule and other pertinent information. Repeat hardware item numbers used in Finish Hardware Schedule. Include list of abbreviations and finish symbols and their meaning. Include manufacturer's cut sheets for each hardware item.

1.4.2. Samples:

1.4.2.1. Submit samples in accordance with Section 01 30 00 - Administrative Requirements.

1.4.2.2. Do not order hardware from manufacturer until samples have been approved by the Consultant. Hardware and finishes supplied shall be identical to approved samples.

1.4.2.3. Supply 1 of each item of hardware with specified finishes to the Consultant. Label each sample as to manufacturer, type, finishes, size and location for use proposed. Approved samples will be retained for comparison and returned upon completion of the Work.

1.4.2.4. Do not submit substitutions to accepted alternates.

1.5. CLOSEOUT SUBMITTALS

1.5.1. Operational and Maintenance Data:

1.5.1.1. Instruct the Owner's designated representative in proper care and preventative maintenance of hardware to assure longevity of operation.

1.5.1.2. Provide 3 copies of descriptive information, operating, adjustment and maintenance instructions and "As-Built" record of location of each hardware group and other pertinent information.

1.5.1.3. Provide maintenance data, parts list and manufacturer's instructions for each type of door closer, lockset, fire exit hardware and door holder. Provide manufacturer's instructions for proper care of hardware, including lubrication, for incorporation into operation and maintenance instruction manual.

1.5.1.4. Provide this information in 3-ring binders suitably identified in accordance with requirements of Section 01 70 00 – Execution and Closeout Requirements.

1.6. MAINTENANCE MATERIAL SUBMITTALS

1.6.1. Tools: Prior to date of Substantial Performance of the Work, supply a complete set of specialized tools as needed for the Owner's continued adjustment, maintenance and removal and replacement of builders hardware.

1.7. QUALITY ASSURANCE

1.7.1. Qualifications:

1.7.1.1. Suppliers: A recognized architectural door hardware supplier for exit devices, cylinders, power supply, magnetic holders and similar items that has a record of successful in-service performance for supplying door hardware similar in quantity, type and quality to that indicated for this Project and employs an experienced AHC who is available to the Owner, the Consultant and the Contractor at reasonable times during course of the Work for consultation.

1.8. DELIVERY, STORAGE AND HANDLING

1.8.1. Delivery and Acceptance Requirements: Supply scheduled hardware to the Place of the Work.

1.8.2. Storage and Handling Requirements:

1.8.2.1. Pack hardware in suitable wrappings and containers to protect from damage during shipping and storage. Enclose accessories, fastening devices and other loose items with each item. Pack screws, bolts and fastenings necessary for proper installation in same package. Mark packages for easy identification legibly indicating manufacturer's numbers, types, sizes. Markings must include floor, item number and door number.

1.8.2.2. Provide assistance in counting hardware on major shipments to confirm hardware is shown as shipped. Provide inventory list with Finish Hardware Schedule. Obtain assistance from hardware supplier to confirm hardware has been delivered to Site correctly for all major shipments. Be responsible to unload hardware, to check hardware shipments and to set up shelving and organize hardware room.

1.8.2.3. Provide templates, template information, installation instructions and details necessary for preparation and installation of hardware.

1.8.2.4. Provide 3 copies of installation instructions for hardware supplied.

1.9. WARRANTY

1.9.1. Manufacturer Warranty: Warrant the Work of this Section for period of 2 years for general, 10 years for closers and lifetime for butt hinges against defects and/or deficiencies in accordance with the General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period including making good any Work damaged by this Work, to satisfaction of the Consultant and at no expense to the Owner.

PART 2 - PRODUCTS

2.1. MATERIALS

2.1.1. Description:

2.1.1.1. Regulatory Requirements: Provide a Pre-Start Health and Safety Review in accordance with the *Occupational Health and Safety Act,* R.S.O. 1990, c. O.1Regulation 851, Industrial Establishments, as amended. Refer to Section 01 40 00 – Quality Requirements for further requirements.

2.1.2. Finish Hardware:

2.1.2.1. Finish hardware will be paid for under the Cash Allowance in the Bid Form. Products specified in this Section are for installation guidance to suit the project design requirements as applicable.2.1.2.2. Hardware shall match existing hardware in type, manufacturer and finish, or except where noted in the Specifications herein.

2.1.2.3. Provide door closers, locksets and latch sets meeting ANSI/BHMA Qualified Products List. Provide finish hardware in accordance with Finish Hardware Schedule. No substitutions are allowed without written approval of the Consultant.

2.1.3. Fastenings:

2.1.3.1. Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

2.1.3.2. Exposed fastening devices to match finish of hardware.

2.1.3.3. Use fasteners with material through which they pass.

2.1.4. Keying:

2.1.4.1. Key locks to the Owner's requirements (construction master keyed, grand master keyed, sub- master keyed,

2.1.4.2. Provide interchangeable cores to the Owner's grand master key system. Number of keys to be determined by the Owner. Provide a minimum of 2 cut keys per cylinder but coordinate the “maximum” quantity per key group with the Owner before ordering final amounts.

2.1.4.3. Provide operational brass construction cores for locks and cylinders. Cores will be returned to manufacturer when permanent cores are provided.

2.1.4.4. Include permanent cores.

2.1.4.5. Hardware supplier shall provide 20 construction keys for use by the Contractor, as well as 4 construction control keys for use by the Owner.

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions:

3.1.1.1. Before supplying any hardware and installation instructions, carefully check the Drawings for Work requiring hardware, verify door swings, door and frame materials and operating conditions and assure hardware will fit work to be attached.

3.1.1.2. Check Shop Drawings and frame and door lists affecting hardware type and installation, and verify to correctness thereof, or advise of required revisions. Ensure doors, frames and panels requiring additional support are reinforced.

3.1.1.3. Point out special requirements to installer and ensure final adjustment of hardware, in particular closer arms, valves and locksets has all been done properly.

3.1.1.4. Be responsible to check and confirm dimensions for hardware for this project, including door protection, overhead stop sizes, exit devices, power door operators and other related hardware items that may require coordination for sizing.

3.2. INSTALLATION

3.2.1. Supply finish hardware to Section 06 90 00 – General Installations for installation.

3.3. SITE QUALITY CONTROL

3.3.1. Site Tests and Inspections: After installation, have hardware inspected by manufacturer's representative, an experienced AHC who is a member of DHI, who shall certify in writing with a copy to the Consultant, items and their installation are in accordance with Specification requirements and are functioning properly and notify the Consultant of any cases where it has not been properly installed, is defective or is not as specified. Replace or re-install defective or improperly installed hardware at no cost to the Owner.

3.3.2. Supervision: Provide following project services relative to the project co-ordination, supervision and inspection:

3.3.2.1. Provide services of AHC familiar with type of work being performed, with type of the project, for preparation of hardware Shop Drawings (schedule), keying, coordination with other trades, consultation with the Owner and the Consultant and for performing on-Site inspections

3.3.2.2. Inspect to verify hardware has been properly installed and is functioning satisfactorily.

3.3.2.3. Recommend adjustments.

3.3.2.4. Replace defective hardware.

3.3.2.5. Check door closers after installation to ensure adjustment such as backchecking degree has been properly made and if not, make such adjustments or instruct those installing hardware to make these adjustments.

3.3.2.6. Submit 6 copies of the finalized schedule to the Consultant for acceptance. Provide additional copies as required for the project and office use.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this Section.

1.2. SUMMARY

1.2.1. Section Includes: Provide glass and glazing including but not limited to following:

1.2.1.1. glazing borrowed lights and screens.

1.2.1.2. glazing wood doors (glass).

1.2.1.3. window film.

1.2.1.4. miscellaneous specialty glass, gaskets, tapes and glazing materials.

1.2.2. Related Sections: Following description of Work is included for reference only and shall not be presumed complete:

1.2.2.1. Provision of architectural woodwork: Section 06 40 00 - Architectural Woodwork.

1.2.2.2. Supply of hollow steel doors and frames: Section 08 11 13 - Steel Doors and Frames.

1.2.2.3. Supply of wood doors: Section 08 14 00 - Wood Doors.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. EPDM: Ethylene Propylene Diene Monomer.

1.3.1.2. GANA: Glass Association of North America; www.glasswebsite.com.

1.3.1.3. MSDS: Material Safety Data Sheets.

1.3.1.4. MSVD: Magnetically Sputtered Vacuum Deposition.

1.3.1.5. OBC: Ontario Building Code.

1.3.1.6. PVB: Polyvinyl Butyral.

1.3.1.7. PVC: Polyvinyl Chloride.

1.3.1.8. SCAQMD: South Coast Air Quality Management District; www.aqmd.gov.

1.3.1.9. ULC: Underwriters' Laboratories of Canada; www.ulc.ca.

1.3.1.10. VOC: Volatile Organic Compound.

1.3.2. Definitions:

1.3.2.1. Pattern Glass: One type of rolled glass having a pattern impressed on 1 or both sides for light control, bath enclosures and decorative glazing. Sometimes called “rolled”, “figured”, or “obscure” glass.

1.3.2.2. Sandblasted Finish: Surface treatment for flat glass obtained by spraying glass with hard particles to roughen 1 or both surfaces of glass. Effect is to increase obscurity and diffusion.

1.3.2.3. United Inches: Total of 1 width and 1 height of a lite of glass in inches.

1.3.3. Reference Standards:

1.3.3.1.	ANSI Z97.1-04	- Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test
1.3.3.2.	ANSI/ASME B18.6.3-03(08)	- Machine Screws and Machine Screw Nuts
1.3.3.3.	ASTM C509-06	- Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
1.3.3.4.	ASTM C864-05	- Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
1.3.3.5.	ASTM C920-08	- Standard Specification for Elastomeric Joint Sealants
1.3.3.6.	ASTM C1036-06	- Standard Specification for Flat Glass
1.3.3.7.	ASTM C1048-04	- Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass
1.3.3.8.	ASTM C1115-06	- Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories
1.3.3.9.	ASTM C1349-04	- Standard Specification for Architectural Float Glass Clad Polycarbonate
1.3.3.10.	ASTM C1503-01	- Standard Specification for Silvered Flat Glass Mirror
1.3.3.11.	CAN/CGSB-12.6-M91	- Transparent (One-Way) Mirrors
1.3.3.12.	CAN/CGSB-12.12-M90	- Plastic Safety Glazing Sheets
1.3.3.13.	CAN/CGSB-12.13-M91	- Patterned Glass
1.3.3.14.	CAN/CGSB-12.20-M89	- Structural Design of Glass for Buildings
1.3.3.15.	CAN4-S104-M80(85)	- Standard Method of Fire Test of Door Assemblies
1.3.3.16.	CAN4-S106-M80(85)	- Standard Method For Fire Test of Windows and Glass Assemblies
1.3.3.17.	NFPA 80-07	- Standard for Fire Doors and Fire Windows

1.4. SUBMITTALS

1.4.1. Samples:

1.4.1.1. Submit samples of materials identifying quality and type of glass if required by the Consultant before commencing Work. Ensure samples are clearly labelled with manufacturer's name and type.

1.4.1.2. Submit following samples:

1.4.1.2.1. window film.

1.5. CLOSEOUT SUBMITTALS

1.5.1. Operation and Maintenance Data: Provide maintenance data indicating cleaning instructions for inclusion into Maintenance Manual.

1.6. QUALITY ASSURANCE

1.6.1. Qualifications

1.6.1.1. Installers: Provide experienced installer who is trained and experienced in glass and glazing requirements of this Section including familiarization of with standards specified herein and capable to instruct installation requirements of this Section.

1.7. DELIVERY, STORAGE AND HANDLING

1.7.1. Delivery and Acceptance Requirements: Deliver glass and associated materials to Site in original crates and containers with manufacturer's name and brand distinctly marked thereon and with glass labelled as to types. Do not remove labels on glass until after Work is accepted by the Consultant.

1.7.2. Storage and Handling Requirements: Store materials within the building, in a clean, dry location, acceptable or as designated by the Consultant. Fully protect materials from damage of any kind until ready for use.

1.8. SITE CONDITIONS

1.8.1. Ambient Conditions: Do not perform glazing when temperature is less than 7 deg C (44 deg F) or sash or frames are wet, damp or frosted.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are acceptable subject to conformance to requirements of the Drawings, schedules and Specifications:

2.1.1.1. AGC Flat Glass North America Ltd.; www.na.agc-flatglass.com

2.1.1.2. Dow Corning; www.dowcorning.com

2.1.1.3. Guardian Industries Corp.; www.guardian.com

2.1.1.4. Momentive Performance Materials; www.momentive.com

2.1.1.5. PPG Canada Inc.; www.ppgglazing.com

2.1.1.6. Pilkington Special Glass Limited; www.pilkington.com

2.1.1.7. TechniGlas, A Division of ProScience Inc.; www.fireglass.com

2.1.1.8. Tremco Canada; www.tremcosealants.com

2.1.1.9. Viracon; www.viracon.com

2.1.1.10 Or Equivalent

2.1.2. Single Source Responsibility for Sealants, Gaskets and Other Glazing Accessories: Ensure consistent quality of performance by providing glazing sealant and seals from single manufacturer.

2.2. MATERIALS

2.2.1. Description:

2.2.1.1. Regulatory Requirements: Provide a Pre-Start Health and Safety Review in accordance with the *Occupational Health and Safety Act,* R.S.O. 1990, c. O.1Regulation 851, Industrial Establishments, as amended. Refer to Section 01 40 00 – Quality Requirements for further requirements.

2.2.2. Performance/Design Criteria:

2.2.2.1. Design glass and glazing to CAN/CGSB-12.20-M complying to OBC design and fire rating requirements and regulations of Authorities Having Jurisdiction, being the minimum, except where more stringent requirements are specified herein. In case of conflict of requirements comply with most stringent requirements.

2.2.2.2. Provide accessories, closures and trims required and necessary to complete Work.

2.2.2.3. Deflection: Limit glass deflection to flexural limit of glass with full recovery of glazing materials.

2.2.3. Glass: Free from bubbles, waves, discolouration and other defects and of following types for locations indicated on the Drawings or noted on Door Schedule. Ensure glass bears manufacturer's label indicating quality. Leave labels in place until final cleaning.

2.2.4. Single Glazed Glass Types:

2.2.4.1. Tempered Glass (TGL): Clear transparent tempered glass conforming to ASTM C1048, Kind FT and meeting requirements of ANSI Z97.1, minimum 6 mm (1/4") thick. Ensure surface compression is equal to or greater than 69 MPa (10 000 psi).

2.2.4.2. Tempered Laminated Glass (TLGL): Clear transparent laminated tempered glass conforming to ASTM C1172, Kind LT and meeting requirements of ANSI Z97.1, minimum 6 mm (1/4") thick overall; clear PVB interlayer of 1.6 mm (0.060") thickness.

2.2.5. Window Film: Provide "3M Scotchcal ElectroCut Special Effects Film" by 3M; www.3m.com in colour "7725-314 Dusted Crystal", translucent opacity, transparent synthetic liner, clear pressure sensitive adhesive, or Equivalent. Ensure film cutouts suit design and are located on glass doors and other areas as indicated on the Drawings.

2.2.6. Glazing, Sealing Compounds and Accessories:

2.2.6.1. Ensure glazing, sealing compounds and accessories are compatible with contact surfaces of frames, other accessories used in glazing system and contact surfaces of compounds used on insulated glass units. Wood or other organic materials are not acceptable for use in glazing systems including spacer blocks.

2.2.6.2. Glazing Compound: Non-hardening modified oil type. Colour to match adjacent surfaces unless indicated otherwise.

2.2.6.3. Sealant Compound: One component type, elastomeric chemical curing, ASTM C920, Type S, Grade NS. Colour to match adjacent surfaces unless indicated otherwise in the Contract Documents.

2.2.6.4. Sealant Compound: ASTM C920, multi-component chemical curing, Type M, Grade NS. Colour to match adjacent surfaces.

2.2.6.5. Sealant Compound: One component, silicone base solvent curing. Colour to match adjacent surfaces.

2.2.6.6. Sealant for Interior Glass-to-Glass Butt Glazing Installation: Translucent 1 part silicone sealant conforming to ASTM C920, Type S, Grade NS, "Tremsil® 200 General Construction Grade Silicone Sealant" by Tremco Canada or "Dow Corning 999-A Silicone Building & Glazing Sealant" by Dow Corning or “GE Contractors SCS1000 Silicone Sealant” by Momentive Performance Materials or Equivalent.

2.2.6.7. Cellular Gaskets for Compression Glazing: ASTM C509 cellular, elastomeric, preformed, black. Closed cell neoprene or EPDM extrusions including moulded corners where applicable by Cellular Rubber Extrusions, Tremco Canada or Equivalent.

2.2.6.8. Dense Gaskets for Compression Glazing: ASTM C864, Option II or ASTM C1115, Type C, dense neoprene or EPDM extrusions, 60 and 70 Durometer density including molded corners where applicable by Poly-Wej Gaskets, Tremco Canada or Equivalent.

2.2.6.9. Glazing Splines: Neoprene or EPDM manufacturer's standard dry glazing splines to suit aluminum extrusions. Colour to match adjacent surfaces unless indicated otherwise.

2.2.6.10. Glazing Points and Wire Spring Clips: Corrosion resistant, manufacturer's standards.

2.2.6.11. Edge Blocking, Setting Blocks, Later Shims, Gaskets and Tapes:

2.2.6.11.1. Edge Blocking for Glass: 60 - 70 Durometer neoprene, silicone or EPDM, channel shaped, 100 mm - 150 mm (4" - 6") long.

2.2.6.11.2. Setting Blocks: 7 mm x 100 mm (5/16 x 4") EPDM or extruded 80 - 90 Durometer neoprene; at insulating glass, use EPDM only. At fire-rated glazed doors and partitions, use similar sized fire-rated silicone GE "Gel 516" or asbestos cement blocks. Width; 1.6 mm to 3 mm (1/16" to 1/8") less than design glazing pocket width. For 4 sided structural glazing, use silicone compatible rubber or silicone.

2.2.6.11.3. Lateral Shims: Neoprene, silicone or EPDM, 40 - 60 Durometer, 100 mm (4") long or as required.

2.2.6.11.4. Compression Glazing Tape: Preformed, ribbon-shaped, non-skinning, 100% solids, non-oxidizing polyisobutylene: butyl, paper release, EPDM shim with continuous synthetic rubber spacer rod of 60 Durometer hardness. Acceptable Product: "Polyshim II Tape" by Tremco Canada or Equivalent. Ensure tape is sufficiently wide and thick to completely cover bite area of glazing unit when unit is pushed into place.

2.2.7. Primer Sealers and Cleaners: To glass and plastic glazing manufacturer's standards.

2.2.8. Fabrication:

2.2.8.1. Label each light of glass and/or plastic glazing with registered name of Product and weight and quality of glass and/or plastic glazing.

2.2.8.2. Check dimensions on job site before cutting materials.

2.2.8.3. Grind and chamfer edges of unframed glass and mirrors. Grind and chamfer edges of glass shelves and sliding doors.

2.2.8.4. Ensure minimum bite or lap of glass and/or plastic glazing on stops and rabbets as recommended by glass and/or plastic glazing manufacturer.

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions:

3.1.1.1. Verify the actual Site dimensions and location of adjacent materials prior to commencing Work. Notify the Consultant in writing of any conditions which would be detrimental to the installation.

3.1.1.2. Ensure glass is not more than 4 mm (3/16") less than the rebate size in either dimension, with allowance for edge spacers, shims and setting blocks as required.

3.1.2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2. PREPARATION

3.2.1. Surface Preparation:

3.2.1.1. Thoroughly clean glass rebates and glass of dust, dirt, mortar and other foreign materials prior to glazing. Remove oils and grease with non-staining solvents such as Xycol or Methyl Ethyl Ketone solutions.

3.2.1.2. Properly prime, before glazing, glazing rebates in wood doors.

3.3. INSTALLATION

3.3.1. Perform the work of this Section in accordance with “GANA Glazing Manual, 2004” and GANA Laminated Glazing Reference Manual, 2006” for laminated glazing installation methods.

3.3.2. If required, thoroughly mix glazing compound as recommended by manufacturer. Thinning of glazing compound will not be permitted.

3.3.3. Carefully remove glazing stops and replace after glazing. Take care to prevent damage to stops.

3.3.4. Doors, Screens, Sidelites and Interior Windows:

3.3.4.1. Place setting blocks on sill at 1/4 points from each corner unless otherwise directed by glazing manufacturer.

3.3.4.2. Place continuous glazing gaskets on edges of glass.

3.3.4.3. Centre and space each piece of glass with spacers located and installed according to manufacturer's directions.

3.3.4.4. Place glass so no voids occur between glass and glazing material and glazing stops.

3.3.4.5. Secure glass in place with stops, secured in place with screws.

3.3.5. Glazing Sealant:

3.3.5.1. Apply glazing sealant to clean, dry, grease and oil free surfaces. Provide exposed glazing sealant smooth, free from ridges, wrinkles, air pockets and embedded foreign materials.

3.3.5.2. Prime surfaces if required by glazing sealant manufacturer.

3.3.5.3. Trim glazing sealant flush with tops of stops and glazing channels.

3.3.5.4. Remove excess glazing sealant or droppings which would set up or become difficult to remove from finished surfaces. Do not use chemicals, scrapers, or other tools which would affect finished surfaces.

3.3.6. Interior Glazing:

3.3.6.1. Tape/Tape Method:

3.3.6.1.1. Cut glazing tape to proper length and install against permanent stop projecting 1.6 mm (1/16") above sightline.

3.3.6.1.2. Place glazing tape on free perimeter of glass projecting 1.6 mm (1/16") above sightline.

3.3.6.1.3. Trim off excess tape to sightline.

3.3.6.2. Combination Method-Tape/Sealant:

3.3.6.2.1. Cut glazing tape to proper length and install against permanent stop projecting 1.6 mm (1/16") above sightline.

3.3.6.2.2. Fill gap between glass and applied stop with sealant to depth equal to bite of frame on glass to uniform and level line.

3.3.6.2.3. Trim off excess tape to sightline.

3.3.6.3. Window Film:

3.3.6.3.1. Install window film in accordance with manufacturer's printed instructions by experienced film applicators as recommended by glass film manufacturer.

3.3.6.3.2. Ensure glass surfaces are clean and ambient temperature is between 16 deg C and 38 deg C (61 deg F and 100 deg F).

3.3.6.3.3. Whenever 2 or more pieces of same colour translucent film are seamed together as a continuous band of colour, they must match to ensure uniform reflected daytime colour and transmitted night appearance.

3.4. SITE QUALITY CONTROL

3.4.1. Site Tests and Inspections: Ensure framing to be glazed is plumb, secure and permanently fixed in position.

3.4.2. Non-Conforming Work: Replace damaged Work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of the Consultant at no cost to the Owner.

3.5. CLEANING

3.5.1. Clean installed glass and metal frequently during construction. Avoid etching and staining glass and metal during construction.

3.5.2. Remove sealant and compound droppings from finished surface.

3.5.3. Remove markings and labels at time of final clean-up. Ensure final clean-up is carried out in accordance with glass and sealant manufacturer's recommendations to the Consultant's satisfaction.

3.5.4. Avoid storing materials adjacent to glass.

3.6. PROTECTION

3.6.1. Provide and maintain necessary protection of completed work against damage.

3.6.2. Do not mark or attach anything directly to exposed glass and framing surfaces.

3.6.3. If welding is to take place above or near completed glazing work, protect glass with plywood or other suitable means to reduce likelihood of weld spatter damaging glass surfaces.

3.6.4. Protect glass from other trades, workers, tools and other similar materials.

3.6.5. Replace cracked, broken, or defective glass at no additional cost to the Owner and to the Consultant's satisfaction.

3.6.6. Identification of Glazing: Mark glass lites with temporary, easily removable, large safety markings, immediately after glass installation. Maintain safety markings until final clean-up.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this Section.

1.2. SUMMARY

1.2.1. Section Includes: Provide gypsum board Work including but not limited to following:

1.2.1.1. steel studs and furring channels.

1.2.1.2. gypsum board ceilings, partitions, bulkheads and soffits.

1.2.1.3. corner beads, casing beads, trim, control joints and corner reinforcement.

1.2.1.4. taping and filling.

1.2.2. Related Sections: t h e following description of Work is included for reference only and shall not be presumed complete:

1.2.2.1. Grouting of door frames: Section 06 90 00 - General Installations.

1.2.2.2. Firestopping, smoke seals and penetration firestopping: Section 07 84 00 - Firestopping and Smoke Seals.

1.2.2.3. Finish painting of gypsum board: Section 09 91 00 - Painting.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. CSA: Canadian Standards Association; www.csa.ca.

1.3.1.2. MSDS: Material Safety Data Sheets.

1.3.1.3. OBC: Ontario Building Code, 2006.

1.3.1.4. SCAQMD: South Coast Air Quality Management District; www.aqmd.gov.

1.3.1.5. ULC: Underwriters' Laboratories of Canada; www.ulc.ca.

1.3.1.6. VOC: Volatile Organic Compound.

1.3.2. Definitions:

1.3.2.1. Drywall: Gypsum board.

1.3.3. Reference Standards:

1.3.3.1. ASTM A653/A653M-07 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

1.3.3.2.	ASTM A666-03	- Standard Specification for Annealed or Cold Worked Austenitic Stainless Steel, Sheet, Strip, Plate and Flat Bar
1.3.3.3.	ASTM A1011/A1011M-07	- Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
1.3.3.4.	ASTM C475/C475M-02(07)	- Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
1.3.3.5.	ASTM C514-04	- Standard Specification for Nails for the Application of Gypsum Board
1.3.3.6.	ASTM C645-08a	- Standard Specification for Nonstructural Steel Framing Members
1.3.3.7.	ASTM C754-07	- Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
1.3.3.8.	ASTM C834-05	- Standard Specification for Latex Sealants
1.3.3.9.	ASTM C840-08	- Standard Specification for Application and Finishing of Gypsum Board
1.3.3.10.	ASTM C919-08	- Standard Practice for Use of Sealants in Acoustical Applications
1.3.3.11.	ASTM C920-08	- Standard Specification for Elastomeric Joint Sealants
1.3.3.12.	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
1.3.3.13.	ASTM C1047-05	- Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
1.3.3.14.	ASTM C1177/C1177M-06	- Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
1.3.3.15.	ASTM C1280-07	- Standard Specification for Application of Gypsum Sheathing
1.3.3.16.	ASTM C1325-08	- Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement Interior Substrate Sheets
1.3.3.17.	ASTM C1396/C1396M-06a	- Standard Specification for Gypsum Board
1.3.3.18.	ASTM C1629/C1629M-06	- Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels
1.3.3.19.	ASTM C1658/C1658M-06	- Specification for Glass Mat Gypsum Panels
1.3.3.20.	ASTM D3273-00(05)	- Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
1.3.3.21.	ASTM D4060-07	- Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
1.3.3.22.	ASTM D5420-04	- Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)

1.3.3.23. ASTM E84-08a - Standard Test Method for Surface Burning Characteristics of Building Materials

1.3.3.24. ASTM E90-04 - Standard Test Method for Laboratory Measurement for Airborne Sound Transmission Loss of Building Partitions

1.3.3.25. ASTM E96/E96M-05 - Standard Test Methods for Water Vapor Transmission of Materials

1.3.3.26. ASTM E119-08a - Standard Test Methods for Fire Tests of Building Construction and Materials

1.3.3.27. CAN/ULC-S101-07 - Standard Methods of Fire Endurance Tests of Building Construction and Materials

1.3.3.28. ASTM E695-03 - Standard Test method of Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading

1.3.3.29. ASTM E814-08b - Standard Test Method for Fire Tests of Penetration Firestop Systems

1.3.3.30. CSA A123.3-05 - Asphalt Saturated Organic Roofing Felt

1.3.3.31. CSA S136-07 - North American Specification for Design of Cold-Formed Steel Structural Members

1.3.3.32. CAN/CGSB-51.33-M89 - Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction

1.3.3.33. CAN/ULC-S101-07 - Method of Test for Standard Methods of Fire Endurance Tests of Building Construction and Materials

1.3.3.34. CAN/ULC-S102-07 - Surface Burning Characteristics of Building Materials and Assemblies

1.3.3.35. CAN/ULC-S114-05 - Standard Method of Test for Determination of Non-Combustibility in Building Materials

1.3.3.36. CAN/ULC-S115-05 - Standard Method of Fire Tests of Firestop Systems

1.3.3.37. CAN/ULC-S702-97 - Standard for Thermal Insulation Mineral Fibre for Buildings

1.4. ADMINISTRATIVE REQUIREMENTS

1.4.1. Sequencing:

1.4.1.1. Coordinate installation and cooperate with mechanical and electrical Subcontractors to accommodate mechanical electrical items and any other Work required to be incorporated into or coordinated with ceiling and soffit systems.

1.4.1.2. Cooperate and coordinate with Sections applying wet trades and Subcontractors installing mechanical and electrical services. Coordinate stud layout at partitions accommodating wall mounted fixtures by other trades.

1.5. SUBMITTALS

1.5.1. Shop Drawings: Submit Shop Drawings in accordance with Section 01 30 00 – Administrative Requirements showing design, construction, sound attenuating construction, adjacent construction, elevations, finishes and relevant details of furring, enclosures and partitions which require fire rating.

1.5.2. Samples: Submit samples in accordance with Section 01 30 00 – Administrative Requirements. Submit following samples in sizes indicated:

1.5.2.1. each trim accessory a minimum of 300 mm (12") long.

1.6. QUALITY ASSURANCE

1.6.1. Qualifications:

1.6.1.1. Installers: Provide the Work of this Section executed by competent installers with a minimum of 5 years' experience in application of Products, systems and assemblies specified.

1.7. DELIVERY, STORAGE AND HANDLING

1.7.1. Delivery and Acceptance Requirements: Deliver materials to Site with the manufacturer's original labels intact. Do not remove wrappings until ready for use.

1.7.2. Storage and Handling Requirements:

1.7.2.1. No outside storage permitted. Store in clean, dry area, off ground. Provide adequate ventilation to avoid excess moisture, surface relative humidity and mould or fungal growth. Remove immediately any board showing signs of mould, mildew or fungal growth.

1.7.2.2. Stack gypsum board flat on level and dry surface without overhanging boards. Prevent sagging and damage to edges, ends and surfaces. Protect bagged Products from moisture or wetting.

1.8. SITE CONDITIONS

1.8.1. Ambient Conditions:

1.8.1.1. Do not install the Work of this Section in any area unless satisfied that Work in place has dried out and that no further installation of materials requiring wetness, moisture or dampness is contemplated. Ensure relative humidity in area of the work of this Section does not exceed 55% for duration of the project.

1.8.1.2. Ensure temperature of surrounding areas is min 13 deg C (55 deg F) and max 21 deg C (70 deg F) for 7 Days before and during application of gypsum board; maintain for 4 Days thereafter. Ensure heat is provided at appropriate time before Work has started to bring surrounding and adjacent materials up to required temperature and maintained as specified. Avoid concentrated or irregular heating during drying by means of deflectors or protective screens.

1.8.1.3. Ensure ventilation is provided for proper drying of joint filler and adhesive and to prevent excessive humidity. Do not force dry adhesives and joint treatment.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are acceptable subject to conformance to requirements of the Drawings, Schedules and Specifications:

2.1.1.1. Bailey Metal Products Ltd.; www.bmp-group.com

2.1.1.2. CertainTeed Corporation; www.certainteed.com

2.1.1.3. CGC Inc.; www.cgcinc.com

2.1.1.4. Chicago Metallic; www.chicagometallic.com

2.1.1.5. Georgia-Pacific Canada, Inc.; www.gpgypsum.com

2.1.1.6. Gordon Incorporated; www.gordongrid.com

2.1.1.7. Roll Formed Specialty; www.rollformed.com

2.1.1.8. Trim-Tex Inc.; www.trim-tex.com

2.1.1.9. Unifix Inc.; www.unfixinc.com

2.1.1.10. Or Equivalent

2.2. MATERIALS

2.2.1. Performance/Design Criteria:

2.2.1.1. Obtain services of Professional Engineer with experience in type of Work of comparable complexity and scope, licensed to practice in the Province of Ontario to design, review and provide professional services for the Work of this Section.

2.2.1.2. Design ceiling suspension system in accordance with manufacturer's printed directions and conforming to ASTM C754 requirements. Do not suspend any items from structural steel deck. Do not support the Work of this Section from, nor make attachments to, ducts, pipes, conduits or support framing of other Subcontractors.

2.2.1.3. Design suspended ceiling system for adequate support of electrical fixtures as required by current bulletin of Electrical Inspection Department of Ontario Hydro.

2.2.1.4. Design hanger anchor and entire suspension system static loading not to exceed 25% of their ultimate capacity including lighting fixture dead loads.

2.2.1.5. Design suspension system to support weight of mechanical and electrical items such as air grilles, lighting fixtures, drapery track, drapes and with adequate support to allow rotation/

2.2.2. Steel Studs: CSA S136 and ASTM C645, galvanized sheet steel, minimum 18 mils designation thickness (0.455 mm (0.0179") minimum base steel thickness) (previously 25 ga), minimum Z120 (G40) zinc coating, screw able with crimped web and returned flange, of depth shown in maximum continuous lengths possible. Provide thicker steel where required due to height.

2.2.3. Heavy Duty Studs at Openings: CSA S136 and ASTM C645, galvanized sheet steel, minimum 54 mils designation thickness (1.367 mm (0.0538") minimum base steel thickness) (previously 16 ga), minimum Z120 (G40) zinc coating, screw able with crimped web and returned flange, of depth shown in maximum continuous lengths possible. Provide thicker steel where required due to height.

2.2.4. Furring Channels: CSA S136 and ASTM C645, galvanized sheet steel, minimum 33 mils designation thickness (0.836 mm (0.0329") minimum base steel thickness) (previously 20 ga structural) or minimum 18 mils designation thickness (0.455 mm (0.0179") minimum base steel thickness) (previously 25 ga), minimum Z120 (G40) zinc coating, screw channels, 67 mm (2-5/8") wide x 22 mm (7/8") deep.

2.2.5. Carrying Channels for Gypsum Board: CSA S136 and ASTM C645, galvanized sheet steel, minimum 43 mils designation thickness (1.087 mm (0.0428") minimum base steel thickness) (previously 18 ga), minimum Z120 (G40) zinc coating, 38 mm (1-1/2") high with 19 mm (3/4") flanges, for primary carrying member in suspended ceilings and as horizontal stiffeners or bracing in metal stud systems.

2.2.6. Gypsum Board (GB): Conforming to ASTM C1396/C1396M. Unless indicated otherwise use 1200 mm (4') wide standard facing board in maximum continuous lengths up to 3600 mm (12'), beveled and/or tapered edges to suit design requirements with butted square ends:

2.2.6.1. Gypsum Board (Walls): Provide 15.9 mm (5/8") thick with tapered edges unless otherwise specified as follows:

2.2.6.1.1. Provide 9.5 mm (3/8") thick gypsum board on curved walls.

2.2.6.1.2. Provide 12.7 mm (1/2") or 15.9 mm (5/8") thick gypsum board on wood framed construction.

2.2.7. Abuse Resistant Gypsum Board (ARGB): Provide 1 of following:

2.2.7.1. Enhanced gypsum core encased in heavy duty paper facers on front and back, 16 mm (5/8"), conforming to ASTM C1396/C1396M and attaining a maximum of 0.014" as tested to ASTM D4060 (H-18 abrasion wheel, 500 grams, 200 cycles), a maximum of 0.123" indentation as tested to ASTM D5420 (72 in lbs) and a minimum of (133 ft lbs) as tested to ASTM E695 (50 lb bag) and ASTM C1629/C1629M Type X in fire rated assemblies, “ProRoc Abuse Resistant Type X” by CertainTeed Corporation or Equivalent.

2.2.7.2. Enhanced gypsum core encased in fibreglass facers on front and back, 16 mm (5/8"), conforming to ASTM C1629/C1629M and attaining a maximum of 0.014" as tested to ASTM D4060 (H-18 abrasion wheel, 500 grams, 200 cycles), a maximum of 0.123" indentation as tested to ASTM D5420 (72 in lbs) and a minimum of (133 ft lbs) as tested to ASTM E695 (50 lb bag) and ASTM C1629/C1629M Type X in fire rated assemblies, “DensAmor Plus® Abuse Guard” by Georgia-Pacific Canada, Inc. or Equivalent.

2.2.8. Joint Tape: Conforming to ASTM C475/C475M, provide following:

2.2.8.1. Regular Gypsum Board: Use either kraft paper joint tape with feathered edges and minute perforations 50 mm (2") wide.

2.2.9. Joint Fillers and Topping Compound: Either slow or fast setting, low shrinkage type free of asbestos fillers and as recommended by the manufacturer. Use “Gyproc 90" by Georgia-Pacific Canada, Inc. or “Durabond 90" by CGC Inc. or Equivalent at exterior soffits.

2.2.10. Metal Trim: CGC No.200-A or BMP D-4411 in lieu of "J" Mould. Do not provide "J" Mould (CGC No. 400-A) unless specifically noted on the Drawings as 'Exposed "J" Mould'.

2.2.11. Sound Control Materials:

2.2.11.1. Sound Attenuation Batts: CAN/ULC-S702, mineral (glass and rock wool) fibre, flame spread and smoke developed in conformance with OBC requirements and other Authorities Having Jurisdiction in accordance with CAN/ULC-S102. Non-combustible in accordance with requirements of CAN/ULC-S114. Acceptable Products: “QuietZone Accoustical Batts” by Owens Corning, “Roxul AFB - Acoustical Fire Batts” by Roxul Inc., "Fibrex Sound Attenuation Batt (SAFB) Insulation" by Fibrex Insulations Inc., or “Thermafibre Sound Attenuation Blankets” by CGC Inc. or Equivalent, of sufficient thickness to meet required STC rating for sound-rated partitions and of width to suit metal framing spaces.

2.2.11.2. Strip Impalement Clips: 25 mm (1") wide strip of Insul-Hold by Insul-Hold Canada Ltd. Or Equivalent, fabricated from 0.531 mm (25 ga) galvanized sheet metal in 30 mf (100') rolls with punch-out insulation securement arrows. Alternatively, use special studs with punch-out impalement strips.

2.2.11.3. Acoustic Sealant: ASTM C834 and ASTM C920, Class 25, Non-hardening, “QuietZone Acoustic Sealant” by Owens Corning or “Tremco Acoustical Sealant” by Tremco Canada or Equivalent.

2.2.11.4. Elastomeric Sealant: As recommended by manufacturer of fibre-reinforced gypsum sheathing board.

2.2.11.5. Gaskets: Closed cell neoprene, 3 mm (1/8") thick x 64 mm (2-1/2") wide.

2.2.11.6. Asphalt Felt: CSA A123.3; No. 15 Type.

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions: Verify the actual Site dimensions and location of adjacent materials prior to commencing Work. Notify the Consultant in writing of any conditions which would be detrimental to the installation.

3.1.2. Evaluation and Assessment: Commencement of Work implies acceptance of previously completed work.

3.2. INSTALLATION

3.2.1. Partition Types:

3.2.1.1. Refer to Drawings for partition types.

3.2.1.2. Provide partitions complete to underside of structure, unless otherwise indicated on the Drawings.

3.2.2. Give a minimum of 48 hours' notice for the Consultant's inspection of internal wall insulation, vapour barriers and services prior to concealing with gypsum board.

3.2.3. Provide adequate ventilation to eliminate excessive moisture before commencing and during Work to ensure proper drying of joint filler and adhesive. Do not force dry adhesive and joint treatment.

3.2.4. Examine substrate for compliance with applicable requirements, installation tolerances and other conditions affecting installation of fibre-reinforced gypsum board or sheathing. Do not proceed until unsatisfactory conditions have been corrected. Beginning of installation indicates acceptance of substrate conditions.

3.2.5. Carry out Work using skilled tradesmen carefully supervised by competent foremen. Take measurements accurately.

3.2.6. Install framing, blocking and furring in accordance with ASTM C645, ASTM C1280 and ASTM C840.

3.2.7. Maintain wallboard panels minimum 6 mm (1/4") and maximum 13 mm (1/2") above floor to prevent moisture transfer. Unless otherwise shown, extend panels to minimum 100 mm (4") above finished ceiling and to underside of deck or structure where exposed and at fire rated and sound control partitions. Omit taping and filling of concealed surfaces above ceiling line, except at fire rated and sound control partitions and walls.

3.2.8. Erect plain wallboard vertically or horizontally, whichever results in fewer end joints. Keep end joints away from prominent locations and central portions of ceilings. Locate vertical joints at least 300 mm (12") from jamb lines of openings.

3.2.9. Space screws for regular wallboard at 300 mm (12") oc along board edges and in board field on walls and ceilings; at fire-rated assemblies, reduce spacings to comply with labelling Authorities assembly listings. For other specialty boards ensure screw spacing is in accordance with the manufacturer's recommendations.

3.2.10. Drive screws with power screw-gun and set with countersunk heads slightly below surface of board. Do not secure gypsum board by installing screws into aluminum or steel window and door frames.

3.2.11. Install resilient sponge tape where gypsum board ceilings abut heads of door frames and where wallboard abuts heads or jambs of exterior door and window frames. Adhere tape to casing bead and compress

during installation. Compressed thickness; 1.6 mm (1/16").

3.2.12. At partitions except shaft walls, apply 1 continuous 6 mm (1/4") bead of acoustical sealant to each side of partition where gypsum board meets dissimilar materials. Where 2 layers of gypsum board per face are required, apply bead of sealant at perimeter of base layer only.

3.2.13. Apply sealant beads at perimeter of other services and like objects which penetrate wallboard in accordance with manufacturer's directions.

3.2.14. Metal Framing for Partitions and Bulkheads:

3.2.14.1. Comply with recommendations of CGC Drywall Steel-Framed Systems Folder 09250-SA 923 for metal stud partition, ceiling, column fireproofing and bulkhead detailing.

3.2.14.2. Provide partition tracks at floor and underside of ceiling or structure above. Align accurately. Lay out to partition layout.

3.2.14.3. Erect partial height and curved partitions as indicated on the Drawings.

3.2.14.4. Place studs vertically at 400 mm (16") oc unless otherwise specified, not more than 50 mm (2") from abutting walls, and at each side of openings and corners. Position studs in tracks. Cross brace studs as required to provide rigid installation.

3.2.14.5. Provide heavy duty double boxed studs at each side of openings to extend in 1 piece from floor to underside of structure above.

3.2.14.6. Co-ordinate erection of studs and installation of service lines.

3.2.14.7. Provide continuous gasket to separate metal framing from masonry and concrete.

3.2.14.8. Do not secure studs to exterior window framing, or to ceiling grid members.

3.2.14.9. Provide continuous gasket between ceiling and floor tracks, and structure.

3.2.14.10. Metal Stud Reinforcements: Provide hollow structural steel, stud, angle and steel plate sections, galvanized sheet steel minimum 1.214 mm (18 ga) where required to support manufactured components. Weld connections. Ensure rigid and secure installation capable of offering resistance to minimum 227 kg (500 lbs) pull force. Galvanize stud reinforcements in moist areas. Do not use wood blocking for this purpose. Provide additional reinforcing framing studs or furring channels secured between studs for attachment and support without limitations following:

3.2.14.10.1. architectural woodwork.

3.2.14.10.2. fitments and fixtures.

3.2.14.10.3. equipment.

3.2.15. Provide continuous horizontal furring channels as backing to wall cabinets.

3.2.16. Access Doors and Panels: Install access doors and panels supplied as part of the work of Divisions 22, 23 and 26 and where required as part of the Work of this Section in walls, bulkheads, ceilings and soffits.

3.2.17. Metal Furring:

3.2.17.1. Erect furring in accordance with manufacturer's directions and as specified herein.

3.2.17.2. Provide furring rigid, secure, square, level or plumb, framed and erected to maintain finish dimensions and contours indicated. Allow for thermal movement.

3.2.17.3. Furr around ducts, pipes and dropped beams occurring in finished areas and for vertical gypsum board breaks within or at termination of ceilings.

3.2.17.4. Provide metal furring channels fastened to masonry or concrete surfaces in parallel rows at 400 mm (16") oc unless gypsum board is indicated to be adhered directly to masonry or concrete surfaces. Shim metal furring channels to provide a level surface.

3.2.18. Gypsum Board Application:

3.2.18.1. Provide gypsum board in accordance with manufacturer's written installation instructions and finish to requirements of ASTM C840. Ensure moisture resistant gypsum board is installed on any wall/partition containing a plumbing fixture (i.e. water closets, sinks, tubs, etc.).

3.2.18.2. Provide metal trim casing bead at junctions with dissimilar materials. Provide reveals at junctions with dissimilar materials where indicated.

3.2.18.3. Provide curved uniform surfaces by wetting or dampening board or scoring back gypsum board and form to profiles indicated. Provide additional screws and framing members to maintain design curve. Apply joint compound and trowel smooth to provide continuous, smooth radius free from flat spots, facets and trowel marks. Allow gypsum boards to dry thoroughly before handling.

3.2.18.4. Provide finished work plumb, level and true, free from perceptible waves or ridges and square with adjoining work.

3.2.18.5. Cut and fit gypsum board to accommodate or fit around other parts of the Work. Provide the Work of this Section accurately and neatly.

3.2.18.6. Butt gypsum board sheets together in moderate contact. Do not force into place. Place tapered or wrapped edges next to 1 another.

3.2.18.7. Provide gypsum board perpendicular to framing and in lengths that will span ceilings and walls without creating end (butt) joints. If butt joints do occur stagger and locate them as far from centre of walls and ceilings as possible. Accurately fit exposed butt joints together and make edges smooth.

3.2.18.8. Support ends and edges on framing.

3.2.18.9. Fasten gypsum board to metal furring and metal studs with screws. Space screws at 200 mm (8") oc at board edges and 300 mm (12") oc on board field. Ensure perimeter screws are not less than 9 mm (3/8") nor more than 13 mm (1/2") from edges and ends are opposite screws on adjacent boards.

3.2.18.10. Gypsum Board - Single Layer:

3.2.18.10.1. Ceilings: Apply gypsum board to metal furring with screws. Erect board with long dimension parallel to supports. Locate end joints over supporting members. Space screws at 200 mm (8") oc.

3.2.18.10.2. Partitions: Apply gypsum board to metal studs with screws. Erect board with long dimension parallel to supports. Locate end joints over supporting members. Locate vertical joints at least 300 mm (12") from jamb lines of openings. Space screws at 200 mm (8") oc at board edges and 300 mm (12") oc on board field.

3.2.18.10.3. Ceiling and Partition Fasteners: Ensure perimeter screws are not less than 9 mm (3/8") nor more than 13 mm (1/2") from edges and ends are opposite screws on adjacent boards. Drive screws with power screw gun and set with countersunk head slightly below surface of board.

3.2.18.10.4. Joints: Finish all joints unless specified otherwise in the Contract Documents.

3.2.19. Metal Trim and Accessories:

3.2.19.1. Provide metal trim casing beads at reveals; at ceiling-wall intersections and partition perimeters; and at intersection of dissimilar constructions such as gypsum board to concrete.

3.2.19.2. Provide metal trim casing beads where gypsum board abuts against a surface having no trim concealing junction.

3.2.19.3. Provide a 13 mm (1/2") separation gasket between metal trim casing beads and window frames or other cold surfaces or provide sponge tape between gypsum board partition or furring framing, where such framing abuts exterior door or window frame, sponge tape between floor and gypsum board partition track. Ensure tape is either full width or 1 strip 9 mm (3/8") wide on each side of framing member.

3.2.19.4. Provide casing bead and sponge tape where gypsum board abuts materials other than itself and acoustic tile ceilings including at exterior door and window frames, where juncture is not concealed with trim; or elsewhere where indicated on the Drawings. Unless indicated otherwise, use tape 3 mm (1/8") narrower than casing bead to provide recess at exposed side. Compress tape by 25%.

3.2.19.5. Provide metal trim casing beads where indicated on the Drawings.

3.2.19.6. Provide pre-finished metal angle trim supports and provide light pockets and eggcrate grilles and/or louvres in accordance with manufacturer's instructions. Install light pockets and eggcrate grilles and/or louvre units square, straight and in 1 piece where possible or with inconspicuous joints at long runs.

3.2.20. Control Joints:

3.2.20.1. Provide pre-fabricated, pre-manufactured control joints and/or prepared to suit site conditions control joints and in accordance with manufacturer's instructions and in accordance with ASTM C840.

3.2.20.2. Set in gypsum facing board, supporting control joints with studs or furring channels on both sides of joint. Ensure double studs with discontinuous tracks and double suspended ceiling furring channels have been installed prior to commencing board and bead application at control joints. Provide control joints at following locations:

3.2.20.2.1. support construction changes.

3.2.20.2.2. partition, ceiling or furring runs exceed 9000 mm (30').

3.2.20.3. Provide control joints full height floor to ceiling or door header to ceiling in partitions and furring runs.

3.2.20.4. Provide control joints from wall to wall in ceiling areas.

3.2.20.5. Provide continuous polyethylene dust barrier behind and across control joints.

3.2.20.6. Obtain the Consultant's acceptance of exact locations of control joints.

3.2.21. Sound Control:

3.2.21.1. Where indicated on the Drawings, provide sound rated partitions and ceiling in locations indicated to meet required minimum STC rating. Apply gypsum board on both sides of sound-proofed partitions. Follow manufacturer's details and recommendations.

3.2.21.2. Provide sound attenuation insulation to completely fill height of stud cavities. Tightly butt ends and sides of blankets within cavities. Cut blankets to fit small spaces. Carefully fit

blankets behind electrical outlets, bracing, fixture attachments and mechanical and electrical services.

3.2.21.3. Mechanically fasten blankets to back of gypsum board as recommended by gypsum board manufacturer.

3.2.21.4. At sound attenuating suspended ceiling and enclosures having spring isolator hangers, terminate ceiling or enclosure at adjacent construction by providing continuous isolator strip and sealed joint.

3.2.22. Joint Treatment - Gypsum Board:

3.2.22.1. Verify board is firm against framing members and screw heads are properly depressed.

3.2.22.2. Mix joint compound or ready-to-use compounds according to manufacturer's directions. Use pure, unadulterated, clean water for mixing. Permit mixed material to stand 30 minutes before using. Do not mix more material than can be used within 1 hour. Do not use set or hardened compound. Clean tools and equipment after mixing each batch.

3.2.22.3. Tape and fill joints and corners in accordance with gypsum board manufacturer's printed instructions. Fill either manually, using hand tools of trade, or by a mechanical taping and filling machine of proven efficiency.

3.2.22.4. Remove plastic tape from control joints after finishing with joint compound.

3.2.22.5. After final coats of filler have dried at least 24 hours, sand surface lightly with No. 00 sandpaper to leave it smooth, ready for decoration.

3.2.22.6. Provide finished work smooth, seamless, plumb and true, flush and with square plumb neat corners.

3.2.22.7. Levels of Finish: Provide following levels of finish in accordance with ASTM C840:

3.2.22.7.1. Level 0: No taping, finishing or accessories required for temporary construction or areas where final decoration is not required.

3.2.22.7.2. Level 1: Use this level in plenum areas above ceilings, attics, areas where assembly would generally be concealed or in building service corridors and other areas.

3.2.22.7.3. Level 2: Use this level where water resistant gypsum backing board is used as substrate for tile; may be used in garages, warehouse storage, or other similar areas where surface appearance is not of primary concern.

3.2.22.7.4. Level 3: Use this level in appearance areas which are to receive heavy or medium texture spray or hand applied finishes before final painting or where heavy grade wall coverings are to be applied as final decoration.

3.2.22.7.5. Level 4: Use this level where flat paints, light textures or wall coverings are to be applied.

3.2.22.7.6. Level 5: Use this level to provide a uniform surface and minimize possibility of joint photographing and of fasteners showing through final decoration.

3.2.22.7.7. Exposed Moisture Resistant Gypsum Board Finish: Ensure joints and interior angles have tape embedded in joint compound and 2 separate coats of joint compound applied over all flat joints and 1 separate coat of joint compound applied over interior angles. Cover fasteners heads and accessories with 3 separate coats of joint compound. Ensure surface is smooth and free of tool marks and ridges.

3.2.23. Cutting and Patching: Cooperate and coordinate with the Work of other Sections to obtain satisfactory gypsum board finish work. Do cutting, patching and Make Good as required by installation of the Work of other Sections.

3.3. SITE QUALITY CONTROL

3.3.1. Non-Conforming Work: Replace damaged Work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of the Consultant at no cost to the Owner.

3.4. CLEANING

3.4.1. Clean off beads, casings, joint cement droppings and similar items and remove surplus materials and rubbish on completion and as directed.

3.5. PROTECTION

3.5.1. Provide protection of materials and Work of this Section from damage by weather and other causes. Perform Work in areas closed and protected from damage due to weather. Protect Work of other trades from damage resulting from the Work of this Section. Make Good such damage immediately.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this Section.

1.2. SUMMARY

1.2.1. Section Includes: Provide tiling including but not limited to the following:

1.2.1.1. grouting control joints in floor slab under tile.

1.2.1.2. waterproofing membrane.

1.2.1.3. levelling bed.

1.2.1.4. fast-setting cement leveling bed for interior floors.

1.2.1.5. CIM for both floors and walls.

1.2.1.6. thin-set mortar bond coat.

1.2.1.7. fast-setting thin-set mortar bond coat.

1.2.1.8. floor tile, base and fittings.

1.2.1.9. wall tile.

1.2.1.10. caulking tile control joints.

1.2.1.11. caulking penetrations through wall and floor tile.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. CIM: Crack Isolation Membrane.

1.3.1.2. EGP: Exterior Grade Plywood.

1.3.1.3. MSDS: Material Safety Data Sheets.

1.3.1.4. SCAQMD: South Coast Air Quality Management District; www.aqmd.gov.

1.3.1.5. TTMAC: Terrazzo, Tile & Marble Association of Canada; www.ttmac.com.

1.3.1.6. VOC: Volatile Organic Compound.

1.3.1.7. WHMIS: Workplace Hazardous Materials Information System.

1.3.2. Reference Standards:

1.3.2.1. ANSI A108.6-99(05) - Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy

1.3.2.2.	ANSI A108.8-99(05)	- Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout
1.3.2.3.	ANSI A108.10-99 (05)	- Installation of Grout in Tilework
1.3.2.4.	ANSI A118.1-08	- American National Standard Specifications for Dry-Set Portland Cement Mortar
1.3.2.5.	ANSI A118.3-08	- American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive
1.3.2.6.	ANSI A118.4-08	- American National Standard Specifications for Latex-Portland Cement Mortar
1.3.2.7.	ANSI A118.5-08	- American National Standard Specifications for Chemical Resistant Furan Mortars and Grouts for Tile Installation
1.3.2.8.	ANSI A118.6-08	- American National Standard Specifications for Standard Ceramic Grouts for Tile Installation
1.3.2.9.	ANSI A118.7-08	- American National Standard Specifications for Polymer Modified Cement Grouts for Tile Installation
1.3.2.10.	ANSI A118.10-08	- American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-set Ceramic Tile and Dimension Stone Installation
1.3.2.11.	ANSI A118.11-99(05)	- American National Standard Specifications for EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar
1.3.2.12.	ANSI A118.12-08	- American National Standard Specification for Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation
1.3.2.13.	ANSI A136.1-08	- American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile
1.3.2.14.	ANSI A137.1-08	- Specification for Ceramic Tile
1.3.2.15.	ASTM A185/A185M-07	- Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
1.3.2.16.	ASTM C144-04	- Specification for Aggregate for Masonry Mortar
1.3.2.17.	ASTM C207-06	- Specification for Hydrated Lime for Masonry Purposes
1.3.2.18.	ASTM C373-88(06)	- Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products
1.3.2.19.	ASTM C503-08	- Specification for Marble Dimension Stone (Exterior)
1.3.2.20.	ASTM C627-93(99)	- Standard Method of Evaluating Ceramic Floor Tile Systems using the Robinson-Type Floor Tester
1.3.2.21.	ASTM C648-04a	- Specification for Standard Test Method for Breaking Strength of Ceramic Tile
1.3.2.22.	ASTM C650-04	- Test Method for Resistance of Ceramic Tile to Chemical Substances

1.3.2.23. ASTM C847-06	- Specification for Metal Lath
1.3.2.24. ASTM F1869-04	- Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
1.3.2.25. CAN/CGSB-51.34-M86	- Vapour Barrier, Polyethylene Sheet for Use in Building Construction
1.3.2.26. CSA A3000-08	- Cementitious Materials Compendium
1.3.2.27. CSA A123.3-05	- Asphalt Saturated Organic Roofing Felt
1.3.2.28. CSA A23.1-04	- Concrete Materials and Methods of Concrete Construction
1.3.2.29. ISO 13006:1998	- International Standard – Ceramic Tiles - Definitions, classification, characteristics and marking
1.3.2.30. ISO 10545-7:1996	- International Standard - Ceramic Tiles – Part 7: Determination of resistance to surface abrasion for glazed tiles
1.3.2.31. ISO 13007-1:2004	- International Standard - Ceramic tiles - Grouts and adhesives – Part 1: Terms, definitions and specifications for adhesives
1.3.2.32. ISO 13007-3:2004	- International Standard - Ceramic tiles - Grouts and adhesives – Part 3: Terms, definitions and specifications for grouts

1.4. ADMINISTRATIVE REQUIREMENTS

1.4.1. Pre-installation Meetings: Arrange pre-installation meeting 1 week prior to commencing Work with Subcontractors as designated in the Contract Documents or as requested by the Consultant. Presided over by the Contractor, include the Consultant who may attend, Subcontractor performing work of this trade, testing company's representative and consultants of applicable discipline. Review the Contract Documents for the Work included under this Section and determine complete understanding of requirements and responsibilities relative to the Work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, the Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of the Work of this Section.

1.5. SUBMITTALS

1.5.1. Product Data:

1.5.1.1. Submit manufacturer’s technical data sheets, WHMIS, MSDS and installation instructions for specified materials.

1.5.1.2. Where more than 1 manufacturer’s Products are part of single tile assembly, arrange for each manufacturer to submit a written statement of compatibility with respect to other manufacturer’s materials.

1.5.2. Shop Drawings: Submit Shop Drawings for the Work of this Section in accordance with Section 01 30 00 – Administrative Requirements. In addition to minimum requirements indicate following:

1.5.2.1. details of construction.

1.5.2.2. joint layouts.

1.5.2.3. dimensions.

1.5.2.4. patterns.

1.5.2.5. markings.

1.5.2.6. lettering.

1.5.3. Samples: Submit samples in accordance with Section 01 30 00 – Administrative Requirements. Submit individual sample panels of each colour of ceramic tile, set with adhesive, grouting and bonding method as specified, showing quality, colour and finish of material, grout and pattern of tiles. Ensure each panel is minimum 600 mm x 600 mm (24" x 24").

1.6. CLOSEOUT SUBMITTALS

1.6.1. Operational and Maintenance Data: Submit maintenance instructions in accordance with Section 01 70 00 – Execution and Closeout Requirements. Provide the Owner with 3 copies of TTMAC's "2000 Maintenance Guide". Include specific warnings of any maintenance practice or materials which may damage or disfigure tile work.

1.7. MAINTENANCE MATERIAL SUBMITTALS

1.7.1. Extra Stock Materials:

1.7.1.1. Supply in addition to quantities required for Work, extra materials and Products to be stored by the Owner as follows:

1.7.1.1.1. Provide 20 extra tiles of each type of tile and special units.

1.7.1.2. Deliver extra stock to the Owner as soon as permanent, locking storage facilities are available. Place extra stock in designated storage area where directed by Owner.

1.8. QUALITY ASSURANCE

1.8.1. Qualifications:

1.8.1.1. Manufacturers: Provide Product of company specializing in manufacture of ceramic tile, porcelain tile, mosaics, pavers, trim units, thresholds, setting, grouting and installation Products with a minimum experience of 5 years. Provide test reports if requested by Consultant to substantiate that Products supplied on this Project will be of consistent quality in appearance and physical properties.

1.8.1.2. Installers: Execute the Work of this Section using a company who is a member in good standing with TTMAC and has a minimum of 5 years successful experience in application of Products, systems and assemblies specified. Perform tile Work using skilled mechanics trained and experienced in Work of this complexity. Install waterproofing system using an applicator approved by system manufacturer.

1.9. DELIVERY, STORAGE AND HANDLING

1.9.1. Delivery and Acceptance Requirements:

1.9.1.1. Coordinate deliveries to comply with construction progress schedule and arrange for above ground, under cover storage before materials are delivered to Site.

1.9.1.2. Deliver tile in a manner to avoid chipping, breakage, staining and any other damage.

1.9.1.3. Deliver packaged materials in their original bags and containers clearly identified.

1.9.2. Storage and Handling Requirements:

1.9.2.1. Store and handle tile in a manner to avoid chipping, breakage, staining and any other damage.

1.9.2.2. Store packaged materials in their original bags and containers clearly identified. Keep containers sealed and labels intact unit time of use. Prevent damage or contamination to materials by water, moisture, freezing, excessive heat, foreign matter or other causes. If materials have frozen, do not stir liquids or mix materials until they are completely thawed.

1.9.2.3. Provide secure heated and dry storage facilities on site. Maintain temperatures in storage area between 15 deg C (59 deg F) and 30 deg C (86 deg F).

1.10. SITE CONDITIONS

1.10.1. Ambient Conditions:

1.10.1.1. Do not perform the Work of this Section at temperature below 12 deg C (54 deg F) when using portland cement mortars or dry set mortars, latex portland mortars or bond coat. Maintain temperature between 12 deg C (54 deg F) and 32 deg C (90 deg F).

1.10.1.2. Observe manufacturer's recommended working temperatures for installation of adhesives and grouts.

1.10.1.3. Close doors and windows and turn off direct forced ventilation systems and apparatus. Turn off radiant floor heating systems and protect Work area from direct draft, sun and heat exposure during installation and for at least 72 hours after completion

1.10.1.4. Do not perform Work of this Section when either substrate and/or ambient temperatures are below 10 deg C (50 deg F) or above 35 deg C (95 deg F). Maintain temperature in tiled areas within these temperature limits during installation and for 7 Days after completion of the Work unless otherwise indicated in the Product instructions and/or in ANSI A108 Installation Standard Procedure requirements.

1.11. WARRANTY

1.11.1. Manufacturer Warranty:

1.11.1.1. Warrant the Work of this Section for a period of 2 years against defects, excessive wear and loss of adhesion including replacement of defective tiling, materials, labour costs for demolition of defective Work, accessories and installation systems at Owner's convenience Cracks arising from normal shrinkage and/or expansion of concrete are not considered as structural failure. Hairline cracks in grout joints which result from these causes are considered normal and warranty is not voided as a result of these minor defects.

1.11.1.2. Warrant waterproofing Work of this Section against defects of workmanship and materials and against any actual leakage, for a period of 5 years. Leakage due to structural failure of concrete is excepted.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of the following manufacturers are acceptable subject to conformance to requirements of the Drawings, schedules and Specifications:

2.1.1.1. Custom Building Products; www.custombuildingproducts.com

2.1.1.2. Flextile Ltd.; www.flextile.net

2.1.1.3. Laticrete International, Inc.; www.laticrete.com

2.1.1.4. Mapei Corporation; www.mapei.ca

2.1.1.5 Or Equivalent

2.1.2. Use proprietary Products in full compliance with the manufacturer's recommendations. As far as possible obtain Product from single manufacturer ensuring compatibility with adjacent components while maintaining quality.

2.2. MATERIALS

2.2.1. Description:

2.2.1.1. Regulatory Requirements: Provide a Pre-Start Health and Safety Review as required in accordance with the *Occupational Health and Safety Act,* R.S.O. 1990, c. O.1Regulation 851, Industrial Establishments. Refer to Section 01 40 00 – Quality Requirements for further requirements.

2.2.2. CIM: Provide 1 of following:

2.2.2.1. Two part system made up of liquid rubber and reinforcing fabric to provide crack bridging capability over non-structural cracks, compatible with thin set mortar, supply "Laticrete Blue 92" by Laticrete International, Inc., "WP-980 Waterproof & Crack Isolation Membrane" or "1000 – Flexilastic Crack Isolation and Sound Reduction Membrane" by Flextile Ltd. or Equivalent.

2.2.2.2. Single component highly flexible load bearing peal and stick sheet membrane and primer compatible with tile/stone setting mortars, supply "Mapeguard Primer and Mapeguard SM" by Mapei Corporation or Equivalent

2.2.3. Waterproofing Membrane: Provide 1 of following:

2.2.3.1. Extra heavy duty, seamless, load bearing conforming to ANSI A118.10, for installation of ceramic tile and quarry tile for areas such as bathrooms, plazas, showers, kitchens, fountains, swimming pools and balconies: "Flextile WP-980 Waterproof & Crack Isolation Membrane with Reinforcing Fabric" by Flextile Ltd. or "Latacrete 9235" waterproof membrane system with Latacrete's fiberglass cloth reinforcement by Laticrete International, Inc. or "Mapelastic™ 315" by Mapei Corporation or Equivalent.

2.2.3.2. A single component self-curing liquid rubber polymer that forms a flexible, seamless waterproofing membrane; provide "Hydro Ban" by Laticrete International, Inc. or "Aqua Defense" by Mapei Corporation or Equivalent.

2.2.4. Adhesive and Mortar Materials:

2.2.4.1. Latex Mortar Bond Coat: ISO 13007-1 performance level (C2ES2P2); ANSI A118.4; ANSI A118.11; for improved (C2) cement adhesive with (E) extended open time (S2) high-deformability (>5 mm) and improved (P2) for adherence to EGP characteristics, conforming to ANSI A118.4 and ANSI A118.11 requirements, supply "Laticrete 4237 with Portland Filler Powder" by Laticrete International, Inc., "Kerabond/Keralastic" by Mapei Corporation or "#51 Floor and Wall Mix Thin-Set Mortar" and "#44 High Solids Latex Thin-Set Mortar Additive" by Flextile Ltd. or Equivalent.

2.2.4.2. Enriched, modified Portland cement thin bed mortar, single component, with polymer, conforming to ANSI A118.4 and ANSI A118.11 requirements, supply "Flextile 52"by Flextile Ltd., or "254 Platinum Multipurpose Thin Set-Mortar" by Laticrete or "Ultraflex 3" or "Ultraflex RS" by Mapei or Equivalent.

2.2.5. Grout Materials:

2.2.5.1. Epoxy grout, commercial grade, conforming to ANSI A118.3, for joints greater than 1.5 mm (1/16") less than 12.7 (1/2"), low VOC, non-toxic, non-flammable, non-hazardous during storage, chemically and stain resistant, supply "Flex-Epoxy 100 Grout" by Flextile or "SpectraLOCK PRO Grout" by Laticrete or "Kerapoxy" by Mapei or Equivalent.

2.2.5.2. Grout colours to be later selected by the Consultant from manufacturer's full range of colours.

2.2.5.3. Grout sealer: as recommended by grout manufacturer.

2.2.6. Ceramic Tile:

2.2.6.1. Conforming to ANSI A137.1, ISO 13006. Provide bullnoses, copings, caps, cove base, nosings, corner pieces, and other special units as specified, indicated, and required. Colour as selected by the Consultant from manufacturer's full ranges. Provide tile with minimum following characteristics:

2.2.6.1.1. Water Absorption: ASTM C373 - < 3.0%.

2.2.6.1.2. Breaking Strength: ASTM C648 - > 250 lbs.

2.2.6.1.3. Abrasion Resistance: ISO 10545-7 - Class Four Heavy Traffic.

2.2.6.1.4. Scratch Hardness: MOH's - 7.

2.2.6.1.5. Chemical Resistance: ASTM C650 - Resistant.

2.2.6.1.6. Coefficient of Friction: Wet: < 0.60; Dry: > 0.80.

2.2.6.2. Wall Tile Type TL-1: Supply 108 mm x 216 mm size unglazed porcelain tiles "Color and Dimensions Collection" by Olympia Tile, in colour 'Artic White Bright' or Equivalent.

2.2.7. Grout:

2.2.7.1. Type TL-1/TB-1: Epoxy Grout: Conforming to ANSI A118.3 and ISO 13007-3 (RG) performance level for reactive resin grouts; 100% Solids, 2 component water washable epoxy grout, "Mapei, in #38 Avalanche colour or Equivalent.

2.2.8. Transition Strips and Reducer Strips: Custom made metal extrusion; stainless steel, or brass, or zinc or anodized aluminum type.

2.2.9. Metal Dividers: Brass [Zinc], 15 mm x 15 mm x 3 mm (19/32" x 19/32" x 1/8") continuous angle.

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions:

3.1.1.1. Verify existing conditions and finishes are ready to receive specified tile Work. Ensure backings are structurally sound, level, and plumb within required tolerances. Notify Consultant in writing of unacceptable substrate conditions.

3.1.1.2. Ensure compatibility of adhesives, waterproofing, reinforcing and fillers with adjacent substrate and component coming in contact with these Products.

3.1.1.3. Ensure waterproofing and adhesive manufacturers; examine substrate conditions, verify conditions are suitable for installation prior to commencement and review application procedures. If requested submit written report.

3.1.2. Pre-installation Testing: Perform calcium chloride test in accordance with requirements of ASTM F1869 immediately prior to tiling for moisture on concrete floors around perimeter of areas, at columns and where moisture may be anticipated. Conduct 3 tests for first 93 m^2 (1000 sq ft) and 1 additional test for every 93 m² (1000 sq ft) of flooring. Ensure moisture emission from concrete floor does not exceed 1.36 kg/93 m² (3 lbs/1000 sq ft) in 24 hours unless otherwise stated in flooring Product instructions

and limitations. Do not proceed with installation until moisture problem has been corrected. Provide results to the Consultant prior to commencement of installation.

3.1.3. Evaluation and Assessment:

3.1.3.1. Prior to installation, set aside for further inspection and replacement on a tile for tile basis by tile or dimension stone Supplier, sub-standard tiles, fractured tiles or tiles with chipped corners, pinholes or voids that are unusable for cuts. Ensure this that a Subcontractor responsible for the Work of this Section replaces at its own expense, sub-standard and/or pre-damaged tiles once installed.

3.1.3.2. Carefully select, set-aside and shade-mix tiles and/or dimension stones to a homogeneous blend throughout. During installation, provide supplementary lighting equipment if necessary to easily identify shade differences, which could normally be very slight and provide a standard even aesthetic blend effect. This is best achieved by using a strong floodlight or spotlight fitted to a movable pole stand immediately over the Work area.

3.1.3.3. Before setting, examine tile backs for possible dust or other contaminants. If necessary, use a slightly damp towel and wipe tile backs to remove any such dust or contaminant residue.

3.1.3.4. Commencement of Work implies acceptance of previously completed work.

3.2. PREPARATION

3.2.1. Surface Preparation:

3.2.1.1. Ensure substrates are structurally sound, solid, stable, level, plumb and true to a tolerance in plane of 6 mm in 3 m (1/4" in 10' - 0") in accordance with ANSI A108 specification requirements. Ensure substrates are clean and free of dust, oil, grease, paint, tar, wax, curing agent, primer, sealer, form release agent or any deleterious substance and debris which may prevent or reduce adhesion.

3.2.1.2. Mechanically sand, shot blast or scarify substrate as required to completely remove paint, loosely bonded topping, loose particles and contaminants. Surface etching or contaminant removal by chemical means is not permitted.

3.2.1.3. Apply latex cementitious leveling coat to correct substrate irregularity up to 8 mm (5/16") thickness. Above 8 mm (5/16") correct irregularity by mortar bed method or fast-setting mortar bed method.

3.2.1.4. Ensure substrates are dry.

3.2.1.5. In all cases, structural design of substrate shall not allow a deflection greater than L/360 when tested to 136 kg (300 lb) concentrated loads in accordance with ASTM C627 test method. Deflection and curvature should be uniform over length of the span.

3.2.1.6. Review setting out point with the Consultant for each location, verify patterns and edge condition.

3.2.1.7. Verify substrate expansion joints have been installed properly.

3.3. INSTALLATION

3.3.1. Provide tiling in accordance with TTMAC's "Specification Guide 09 30 00 Tile Installation Manual 2006-2007" unless specified otherwise in the Contract Documents.

3.3.2. Lay out tile so field or patterns are centered on wall and floor areas or conform architectural details so no tile less than 1/2 size occurs. No cut tiles are allowed at finished ceiling level. Align joints in walls, bases and floors, where tile sizes accommodate. Provide uniform joint widths throughout.

3.3.3. Prior to installation ensure back of each tile is free of contaminants. Distribute production run

variations evenly, maintaining continuity of appearance. When necessary, wipe the back face of stone or tile with a damp towel or cloth to remove dust and residual contaminants.

3.3.4. Arrange accessories in tile work so they are spaced evenly, centered with joints and set true with proper and adequate projection conforming to the manufacturer's recommendations.

3.3.5. Make sure tile has adequate solid backing. Ensure corner and edges are fully supported by bonding material. Avoid slippage. Ensure tile installation has a minimum of 95% bond coverage by back-buttering.

3.3.6. Fit tile units around corners, fitments, fixtures, drains and other built-in-objects to maintain uniform joint appearance. Cut, drill and set anchors, bolts for fastening fixtures and fittings in tile work. Make cut edges smooth, even and free from chipping. Do not split tile.

3.3.7. Grout to match colour of tile unless indicated otherwise. Fill joints.

3.3.8. Expansion and Control Joints:

3.3.8.1. Carry existing movement joints all the way through from substrate surface layer including tiling surface. Ensure control and expansion joints are kept free of setting materials.

3.3.8.2. Install control joints where tiling abuts restraining surfaces, around perimeter of work (and or panel) and at base of columns and curbs.

3.3.8.3. Install and space expansion and control joints in accordance with following:

3.3.8.3.1. interior: 4878 mm (16') to 6098 mm (20') in each direction with minimum joint width of 6 mm (1/4").

3.3.8.3.2. interior exposed to direct sunlight or moisture: 2439 mm (8') to 3659 mm (12') in each direction with minimum joint width of 6 mm (1/4").

3.3.8.3.3. exterior - normal: 2439 mm (8') to 3659 mm (12') in each direction with minimum joint width of 9 mm (3/8").

3.3.8.3.4. exterior - excessive: 2439 mm (8') to 3049 mm (10') in each direction with minimum joint width of 13 mm (1/2").

3.3.8.4. Caution: Under no circumstances cut in control joints after tiling has been installed. Install tiling up to movement joint and stop. If required, cut tiling and resume setting from opposite side of the joint. Before continuing, rake joint clean.

3.3.8.5. Install an approved compressible bead and specified sealant to caulk expansion and control joints. Follow sealant manufacturer's installation instructions or install preformed proprietary brand control joint profiles as specified in the Contract Documents.

3.3.9. Ceramic Tile:

3.3.9.1. Provide setting bed in accordance with manufacturer's printed instructions and as specified herein.

3.3.9.2. Prepare gypsum board and cement board surfaces, by applying a scratch coat of setting bed material.

3.3.9.3. Provide setting compound in 1 layer with notched trowel to provide a continuous 3 mm to 6 mm (1/8" to 1/4") bed, in accordance with tile manufacturer's written instructions.

3.3.9.4. Place tiles to achieve uniform:

3.3.9.4.1. shading.

3.3.9.4.2. colouring.

3.3.9.4.3. jointing.

3.3.9.5. Lay tiles in true lines, conforming to lines of building and arrange symmetrically in accordance with the Drawing layouts. Review layout and slopes with the Consultant prior to setting of tiles.

3.3.9.6. Lay out work to produce a symmetrical pattern with minimum amount of cutting. Ensure cut tile at room perimeter is not less than 1/2 full size.

3.3.9.7. Provide slopes to floor drains using levelling bed material.

3.3.9.8. Set wall tile in a true vertical plane with edges of tiles flush with each other.

3.3.9.9. Set floor tile flat and level, with uniform joints throughout, properly aligned. Provide uniform slopes to floor drains.

3.3.9.10. Neatly and closely fit tiles around pipes, accessories and other items occurring in floor and walls. Provide necessary cutting without marring tile.

3.3.9.11. Replace cracked, discoloured, chipped and damaged tile.

3.3.9.12. Align joints of floor, wall and base tiles.

3.3.10. Grouting:

3.3.10.1. Where tiling is installed with normal setting thin-set mortar, grout no sooner than 24 hours after installation.

3.3.10.2. Where tiling is installed with fast-setting mortar system, grout no sooner than 3 to 4 hours after installation.

3.3.10.3. Where tiling or stone tiling is installed with reactive epoxy mortars and adhesives, grout no sooner than 24 hours after installation.

3.3.10.4. Where tiling or stone tiling is installed with reactive polyurethane adhesive, grout no sooner than 24 hours after installation.

3.3.10.5. Install epoxy grouts in accordance with Product instructions and ANSI Al08.6.

3.3.10.6. Install unsanded cement grout in accordance with Product instructions and ANSI A108.10.

3.3.10.7. Install sanded cement grout in accordance with Product instructions and ANSI A108.10.

3.4. SITE QUALITY CONTROL

3.4.1. Non-Conforming Work: Replace damaged Work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of the Consultant at no cost to the Owner.

3.4.2. Manufacturer Services: Have manufacturer's representative visit Site at commencement of tile Work to give proper direction and thereafter at regular interval to ensure proper workmanship.

3.5. CLEANING

3.5.1. Remove grout and mortar residue immediately while work progresses and before materials harden on tiling surface.

3.5.2. Clean tiling completely leaving no apparent cement laitance on the surface. Do not acid wash especially where pigmented grouts are specified.

3.5.3. Clean adjacent surfaces that have been soiled or otherwise marred, to completely remove evidence of materials causing same.

3.5.4. Upon completion, remove protective coverings and clean down finished work of this Section leaving it in a correct condition according to industry standards. Correct defective jointing and grouting and other non-conformities.

3.6. PROTECTION

3.6.1. Protect other parts of Work from spatters, stains or damage.

3.6.2. Remove and replace with new materials, sections of Work that have become stained, soiled, broken, chipped or otherwise damaged.

3.6.3. Protect finished Work from weather, freezing and complete water immersion for periods of at least 72 hours to 14 Days after completion of the Work depending on setting and grouting materials used. Follow Product instructions for requirements.

3.6.4. Walls: Protect walls from impact, vibration and hammering on adjacent and opposite walls for periods of at least 24 hours to 7 Days after installation depending on setting and grouting materials used. Follow Product instructions for requirements.

3.6.5. Floors: Protect floors from foot traffic for at least 4 hours to 48 hours after installation depending on the setting and grouting materials used. In all cases prohibit heavy commercial and equipment traffic for at least 48 hours to 7 Days depending on setting and grouting materials used. Follow product instructions for requirements.

3.6.6. Fabricated Faced Panels: Do not disturb or move panels for at least 7 Days or 72 hours with fast- setting mortar system and allow setting mortar to cure for at least 7 Days to 28 Days before shipping and installing panels on Site depending on setting and grouting materials used. Follow product instructions for requirements.

3.6.7. Since temperature and humidity conditions during and after installation affect final curing time of cement based and epoxy materials, allow for extended periods of cure and protection when ambient and/or substrate temperatures drop below 15 deg C (60 deg F) and/or when relative humidity is higher than 70%.

3.6.8. Protect finished Work from damage by the Work of other Sections and general abuse until Substantial Completion and acceptance.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this Section.

1.2. SUMMARY

1.2.1. Section Includes: Provide acoustic tile ceilings including but not limited to following:

1.2.1.1. ceiling suspension systems.

1.2.1.2. lay-in acoustic ceiling panels.

1.2.2. Related Sections: the following description of Work is included for reference only and shall not be presumed complete:

1.2.2.1. Provision of suspended gypsum board ceilings: Section 09 21 16 - Gypsum Board.

1.2.2.2. Provision of electrical, communication and security fixtures: Division 26, Electrical, Division 27, Communications, Division 28, Electronic Safety and Security.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. STC: Sound Transmission Class.

1.3.1.2. ULC: Underwriters' Laboratories of Canada; www.ulc.ca.

1.3.1.3. cUL: Underwriters Laboratories Inc.; www.ul.com.

1.3.2. Reference Standards:

1.3.2.1.	ASTM C635/C635M-07	- Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
1.3.2.2.	ASTM C636/C636M-08	- Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
1.3.2.3.	CAN/CGSB-92.1-M89	- Sound Absorptive Prefabricated Acoustical Units
1.3.2.4.	CAN/ULC-S101-07	- Standard Methods of Fire Endurance Tests of Building Construction and Materials
1.3.2.5.	CAN/ULC-S102-07	- Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
1.3.2.6.	CAN/ULC-S114-05	- Standard Method of Test for Determination of Non-Combustibility in Building Materials
1.3.2.7.	CAN/ULC-S702-97	- Standard for Mineral Fibre Thermal Insulation for Buildings

1.4. SUBMITTALS

1.4.1. Product Data: Submit Product data on ceiling grid system, acoustic tile panels; clearly indicate specific items proposed for use if manufacturer's catalogues are submitted.

1.4.2. Shop Drawings: Submit Shop Drawings for the Work of this Section in accordance with Section 01 30 00 – Administrative Requirements. In addition to minimum requirements indicate following:

1.4.2.1. reflected plans of ceilings, joint pattern, position of suspension grids, methods of suspension and termination at walls, partitions, bulkheads, lighting fixtures and mechanical fixtures.

1.4.2.2. Submit reflected ceiling plans detailed in measurement system (e.g. imperial or metric) to match the Drawings.

1.4.3. Samples: Submit samples in accordance with Section 01 30 00 – Administrative Requirements. Submit following samples in sizes indicated:

1.4.3.1. Submit 300 mm (12") long samples of suspension system parts, including trim.

1.4.3.2. Submit 300 mm x 300 mm (12" x 12") samples of acoustic panels.

1.4.4. Certificates:

1.4.4.1. Submit independent test data and certificate confirming system meets or exceeds specified STC rating.

1.4.4.2. Submit independent test data and design tables for each type of insert to be employed on this Project for hanger supports.

1.5. CLOSEOUT SUBMITTALS

1.5.1. Operational and Maintenance Data: Submit maintenance instructions to the Owner for recommended cleaning materials and methods for panels and trim. Include precautions for use of and composition of cleaning materials detrimental to acoustic materials and trim.

1.5.2. Extra Stock Materials:

1.5.2.1. Supply in addition to quantities required for work, extra materials and Products to be stored by the Owner as follows:

1.7.1.1.1. Provide 50 new ceiling tiles - uncut

1.5.2.2. Deliver extra stock to the Owner as soon as permanent, locking storage facilities are available. Place extra stock in designated storage area where directed.

1.6. MAINTENANCE MATERIAL SUBMITTALS

1.6.1. Spare Parts: provide 50 new of each type of ceiling panel specified for the Owner's future maintenance use. Supply spare panels from same production run as installed panels.

1.7. QUALITY ASSURANCE

1.7.1. Qualifications:

1.7.1.1. Installers: Provide the Work of this Section executed by competent installers with a minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

1.8. DELIVERY, STORAGE AND HANDLING

1.8.1. Delivery and Acceptance Requirements: Deliver materials in original packages, containers and bundles, bearing brand and manufacturer's name and ULC or cUL labels.

1.8.2. Storage and Handling Requirements:

1.8.2.1. Store materials in a covered area, off ground, on flat, smooth, dry surfaces. Protect from moisture. Remove damaged or deteriorated materials from Site.

1.8.2.2. Comply with ceiling panel manufacturer's recommendations regarding temperature and humidity conditions before, during and after ceiling installation.

1.9. SITE CONDITIONS

1.9.1. Ambient Conditions: Continuously maintain rooms or areas scheduled to receive acoustical treatment at not less than 21 deg C (70 deg F) and at occupancy humidity, at least 3 Days prior to installation and 3 Days after Work is completed. Schedule Work to eliminate risk of damage to these materials due to adverse environmental conditions in rooms or areas when and after Work is installed.

1.10. WARRANTY

1.10.1. Manufacturer Warranty: Warrant Work of this Section for period of 2 years against defects and/or deficiencies in accordance with Article A-6 of the Contract and GC 37 of the General Conditions of the –Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of the Consultant and at no expense to the Owner.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are acceptable subject to conformance to requirements of the Drawings, Schedules and Specifications:

2.1.1.1. Armstrong World Industries Canada Ltd.; www.armstrong.com

2.1.1.2. Or Equivalent

2.2. MATERIALS

2.2.1. Description:

2.2.1.1. Regulatory Requirements:

2.2.1.1.1. Pre-Start Health and Safety Review: Provide a Pre-Start Health and Safety Review in accordance with the *Occupational Health and Safety Act,* R.S.O. 1990, c. O.1Regulation 851, Industrial Establishments, as amended. Refer to Section 01 40 00 – Quality Requirements for further requirements.

2.2.2. Performance/Design Criteria:

2.2.2.1. Design suspension system to support safely and without distortion, superimposed loads of:

2.2.2.1.1. Lighting fixtures.

2.2.2.1.2. Air supply diffusers, boots, fire alarm grilles and exhaust and return air grilles.

2.2.2.1.3. Power grid system, where indicated.

2.2.2.2. Design suspension system to support lighting fixtures according to Ontario Hydro

regulations and submit certification in accordance with Rule 30-302 (1).

2.2.2.3. Prepare panels for sprinkler head penetrations.

2.2.2.4. Coordinate installation and cooperate with mechanical and electrical Subcontractors, to accommodate mechanical and electrical items, or any other Work required to be incorporated in or coordinated with the ceiling system.

2.2.2.5. Whenever possible, acoustical ceiling tiles, steel suspension system and framing used in the work of this Section are to contain recycled content.

2.2.2.6. System Description: 0.85 NRC acoustical mineral fiber ceiling panel, square lay-in with t-bar grid system.

2.2.3. Acoustic Lay-in Panels: CAN/CGSB-92.1-M, acoustical units, prefabricated, with white painted textured and/or smooth face, qualified for use in fire rated ceiling assembly; ULC or cUL labelled and meeting following performance criteria as determined by CAN/ULC-S101 and as specified:

2.2.3.1. Flame Spread Rating: 25 or under.

2.2.3.2. Smoke Developed: 50 or under.

2.2.3.3. Fuel Contributed: 25 or under.

2.2.4. ACT-1: 2’ x4’ x 7/8”, “Calla Square Lay-in #2821”, in White, by Armstrong or Equivalent.

2.2.5. Exposed Grid System: “Prelude 15/16” Exposed Grid” by Armstrong World Industries or Equivalent, factory finished satin white on hot dipped galvanized cold rolled steel.

2.2.6. Basic Steel Material and Finish: Commercial quality cold rolled steel 0.455 mm (26 ga) minimum thickness, galvanized to zinc coating designation Z275 (G90). Ensure exposed surfaces of metal products are factory finished in non-yellowing, low sheen satin white enamel to Consultant’s acceptance to match whiteness in panels. Provide paint formulation of grid system to lighting fixture, speaker grille, sprinkler and diffuser manufacturers to ensure consistency of colour, sheen and texture of all exposed metal components in the ceiling assemblies. Provide slip-on trim mouldings or metal mouldings with baked enamel finish, as standard with grid manufacturer, to trim around light fixtures.

2.2.7. Accessories for Suspension System: Complete with splices, clips and perimeter moulding of manufacturer's standard and aluminum types to suit the applicable conditions unless special conditions and access areas are shown or specified. In high humidity areas provide galvanized suspension system.

2.2.8. Hangers: Minimum 3.2 mm diameter to support 68 kg. per hanger, 4.0 mm diameter to support maximum weight of 138 kg. per hanger and 4.8 mm diameter to support a maximum weight of 250 kg. per hanger, zinc coated annealed steel wire to zinc coating designation Z275 (G90), meeting "Heavy-duty" classification of ASTM C635/C635M,

2.2.9. Hanger anchoring devices, expansion type eyebolt, T14 Eyebolt as manufactured Ramset of HCA 14 by Hilti Canada Ltd., Red Head TW-1614 anchors by Philips Drill Company, Division of ITT Industries of Canada Ltd, or Equivalent.

2.2.10. Hanger Isolators: Vibron VSK-1 or Equivalent to support the ceiling dead load with safety factor of 5.

2.2.11. Carrying Channels: 1.2 mm galvanized steel, 38 m x 13 mm.

2.2.12. Wall Moulding Around Ceiling Perimeters: “Shadow Molding #7871” in White by Armstrong or Equivalent, hemmed with prefinished exposed flanges.

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions: Verify the actual Site dimensions and location of adjacent materials prior to commencing Work. Notify the Consultant in writing of any conditions which would be detrimental to the installation.

3.1.2. Evaluation and Assessment: Commencement of Work implies acceptance of previously completed work.

3.2. INSTALLATION

3.2.1. Do not start installation until exterior glazing has been completed and exterior openings are closed in. Ensure wet Work is completed and dried out to a degree acceptable to panel manufacturer before installation is commenced. Maintain uniform temperatures of at least 21 deg C (72 deg F) for 72 hours prior to commencement of Work and maintain temperature until 72 hours after completion.

3.2.2. Install ceiling panels and metal suspension system in accordance with applicable requirements of ASTM C636/C636M and manufacturer's directions. Where manufacturer's directions are at variance with the Contract Documents, notify the Consultant before proceeding with Work.

3.2.3. Do not commence installation until all Work above suspended ceiling has been completed, reviewed and accepted by Consultant.

3.2.4. Install supporting inserts for hangers of suspended ceiling system into concrete slab above.

3.2.5. Install acoustic ceilings using tradesmen skilled in this class of Work, in accordance with manufacturer's instructions and as specified herein.

3.2.6. Neatly and symmetrically install suspended ceiling to true lines, evenly balanced to pattern indicated on the Drawings.

3.2.7. Centre ceiling system on room axis unless otherwise thereon or directed leaving equal border panels not less than 1/2 a full width.

3.2.8. Recessed items shall replace or be centered on acoustical panels, except where shown otherwise on the Drawings. Consult with mechanical and electrical Divisions to co-ordinate Work. Provide additional supports where required.

3.2.9. Space hangers for suspended ceilings to support grillage independent of walls, columns, pipes and ducts at maximum 1220 mm (4') centres along support grillage and not more than 150 mm (6") from ends. Provide additional hangers at light fixtures and diffusers.

3.2.10. Attach hangers to inserts in overhead concrete slab. Bend top of hangers at right angles, turn down and securely fasten. Turn bottom of hangers upwards and securely wrap 3 times.

3.2.11. Suspension to Metal Deck: Punch lower part of metal deck with special puncher at required distances. Put hanger wire through holes, turn down, make a loop and securely wrap 3 times.

3.2.12. Provide written confirmations to Divisions 21, 22, 23, 26, 27 and 28, when requested by the Consultant, that suspended ceiling is capable of supporting additional weight of mechanical and electrical fixtures specified in Divisions 21, 22, 23, 26, 27 and 28.

3.2.13. Run main tees at right angles to length of light fixtures.

3.2.14. Space main tees 1220 mm (4') oc in 1 direction and securely tie to hangers.

3.2.15. Space cross tees 610 mm (2') oc at right angles to main tees and properly lock at intersections.

3.2.16. Level suspended systems with a maximum tolerance of 3 mm (1/8") over 3.66 m (12').

3.2.17. Use longest practical lengths of tees, furring and running channels to minimize joints. Make joints square, tight, flush and reinforced with concealed splines. Assemble framework to form a rigid and interlocking system.

3.2.18. Design suspension system to accommodate movement caused by thermal expansion or contraction.

3.2.19. Design and space hangers and carrying members to support entire ceiling system, including lighting fixtures, diffusers and equipment openings in locations indicated on the Drawings.

3.2.20. Use edge moulding where ceiling abuts vertical surface.

3.2.21. Use corner moulding along external edges at ceiling steps.

3.2.22. Exposed Grid Lay-in Panel Ceilings:

3.2.22.1. Install direct-hung exposed grid lay-in acoustic panel ceilings where shown. Install main tees, cross tees and wall mouldings so bottom flanges are in flat, level plane at finish ceiling elevations. Arrange grid so opposite wall edge panels are of equal width but not less than 1/2 panel width and lay out and erect grid system to provide following panel pattern as shown on the Drawings.

3.2.22.2. Install exposed ceiling grid per ASTM C636/C636M, reviewed Shop Drawings and specified in this Section.

3.2.22.3. Erect main beams parallel to main wall and to each other; space uniformly at centres Stop ends of main beams 13 mm (1/2") from walls allowing for expansion. Supply main beams in as long lengths as possible to minimize number of joints in a run. Join lengths of main beams together at hangers only; use special splice pieces. In ceilings having recessed lighting fixtures, modify grid framing to provide main beams along and parallel to both long sides of lighting fixtures; at each 300 mm (12") wide fixture, provide an additional main beam along the long side of fixture. At other items recessed in ceiling and designed to be framed by main beams, provide additional main beams necessary. Rest ends of main beams on horizontal leg of wall mouldings.

3.2.22.4. Support main beams with hangers along each run, spaced at not more than 1220 mm (48") centres; except in areas of steel framing, provide hangers at each intersection of main beam and framing. If ductwork or equipment located in ceiling plenum area interferes with hanger spacing, provide a trapeze or other arrangement reviewed by the Consultant to support main beams at proper spacing. Do not secure hangers to metal roof deck, ductwork, conduit, piping, equipment or support system for any of these. Provide an additional hanger at each corner of each opening to receive a recessed lighting fixture and each opening that has been framed by main beam members. Provide additional hangers at each diffuser, grille and other points of extra loading. Secure hangers to main beams to develop full strength of hangers and per manufacturer's published directions. Secure hangers to construction above per ASTM C636/C636M and following requirements:

3.2.22.4.1. Exposed Concrete Slab: Use anchors, cast-in hanger wires or inserts, specifically designed for hanger use.

3.2.22.4.2. Steel Beams: Use beam clips.

3.2.22.4.3. Steel Joists: Wrap hanger wire around lower chord member.

3.2.22.5. Install primary cross tees at right angles to main beam tees and space uniformly at centres. Join ends of cross tees to web of main beams with a positive interlock; except at light fixtures, secure members together with concealed steel clips and bolts. Install tees to produce fine-line joints between flanges of abutting members.

3.2.22.6. Install secondary cross tees at right angles to primary tees and space uniformly at centres. and secure in a manner similar to primary tees.

3.2.22.7. At locations where ceilings abut walls, columns and other vertical surfaces, install continuous wall moulding to trim ceiling edges. Install moulding with bottom horizontal leg at elevation required to support acoustic panel and to be flush with bottom flange of grid members, and with vertical leg concealed. Bolt mouldings to supporting construction at 610mm (24") on centres and within 150 mm (6") of end of each moulding piece. Provide tight, inconspicuous butt joints in moulding if several pieces are required in any 1 run.

3.3. SITE QUALITY CONTROL

3.3.1. Site Tests and Inspections: After interior finishing Work has been substantially completed, or when directed by the Consultant, inspect acoustical treatment Work.

3.3.2. Non-Conforming Work: Replace broken, chipped or damaged Work, reset loose units or units out of place and touch up marred surfaces with matching paint.

3.4. CLEANING

3.4.1. Upon completion of project, acoustical treatment finished surfaces shall be clean and free from dirt and other markings and in good condition acceptable to the Consultant.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this Section.

1.2. SUMMARY

1.2.1. Section Includes: Provide resilient flooring including but not limited to following:

1.2.1.1. underlayment.

1.2.1.2. rubber tile.

1.2.1.3. resilient base.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. MSDS: Material Safety Data Sheets.

1.3.1.2. PVC: Polyvinyl Chloride.

1.3.1.3. SCAQMD: South Coast Air Quality Management District; www.aqmd.gov.

1.3.1.4. VOC: Volatile Organic Compound.

1.3.2. Reference Standards:

1.3.2.1.	ASTM F1066-04	- Standard Specification for Vinyl Composition Floor Tile
1.3.2.2.	ASTM F1344-04	- Standard Specification for Rubber Floor Tile
1.3.2.3.	ASTM F1861-08	- Standard Specification for Resilient Wall Base
1.3.2.4.	ASTM F1869-04	- Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

1.4. SUBMITTALS

1.4.1. Shop Drawings: Submit Shop Drawings for Work of this Section in accordance with Section 01 30 00.

1.4.2. Samples: Submit samples in accordance with Section 01 30 00. Submit following samples in sizes indicated:

1.4.2.1. rubber tile 900 mm (36") square.

1.4.2.2. resilient base 300 mm (12") long.

1.5. CLOSEOUT SUBMITTALS

1.5.1. Operational and Maintenance Data: Submit 3 copies of Product maintenance manual to the Consultant prior Substantial Completion of the Work. Ensure manual contains specific maintenance recommendations and gives specific warning of any maintenance practice or materials which may damage or disfigure resilient flooring and bases.

1.5.1. Extra Stock Materials:

1.5.1.1. Supply in addition to quantities required for Work, extra materials and Products to be stored by the Owner as follows:

1.6.1.1.1. Provide 10 extra tiles

1.5.1.2. Deliver extra stock to the Owner as soon as permanent, locking storage facilities are available. Place extra stock in designated storage area where directed by Owner.

1.6. MAINTENANCE MATERIAL SUBMITTALS

1.6.1. Extra Stock Materials: Leave 5% of total installation including any partially used cases of each colour of resilient tile installed, for Owner's future use. Label cartons as to contents and indicate areas where tiles were used.

1.6.1.1. Supply 2440 mm (96”) of each resilient accessories of each material and colour specified.

1.6.1.2. Supply 5% of all types and finishes of transition strips specified in the Contract Documents.

1.7. QUALITY ASSURANCE

1.7.1. Qualifications:

1.7.1.1. Installers: Provide the Work of this Section executed by competent installers with a minimum of 5 years’ experience in application of Products, systems and assemblies specified and with approval and training of Product manufacturers.

1.8. DELIVERY, STORAGE AND HANDLING

1.8.1. Delivery and Acceptance Requirements: Deliver materials undamaged in original wrappings or containers, with manufacturer's labels and seals intact.

1.8.2. Storage and Handling Requirements:

1.8.2.1. Store materials undamaged in original wrappings or containers, with manufacturer's labels and seals intact. Store materials in a warm, dry area.

1.8.2.2. Prevent damage to materials during handling and storage. Stack material not over 2 cartons in height, nor in excess of allowable floor loading. Store materials on smooth surfaces only, in an area designated by the Consultant.

1.9. SITE CONDITIONS

1.9.1. Ambient Conditions:

1.9.1.1. Provide each flooring Product in accordance with manufacturer's recommended tolerances for:

1.9.1.1.1. substrate moisture content.

1.9.1.1.2. temperature and ventilation.

1.9.1.2. Do not provide flooring under ambient and surface temperatures less than 20 deg C (68 deg F) in any instance for 48 hours before, during and 7 Days after installation.

1.10. WARRANTY

1.10.1. Provide five (5) year warranty against manufacturing defects, excessive wear, discoloration, delamination, wrinkling, failure of adhesive, opening of seams, splitting or blistering commencing on date of Substantial Performance of Work.

1.10.2. Warranty shall include the removal and replacement of ay defective areas, disposal of defective material including moving and replacing of equipment, furniture and other such items to allow installation of replacement material.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are acceptable subject to conformance to requirements of the Drawings, schedules and Specifications:

2.1.1.1. Johnsonite; www.johnsonite.com

2.1.1.2. Or Equivalent

2.2. MATERIALS

2.2.1. Description:

2.2.1.1. Regulatory Requirements: Provide a Pre-Start Health and Safety Review in accordance with the *Occupational Health and Safety Act,* R.S.O. 1990, c. O.1,Regulation 851, Industrial Establishments, as amended. Refer to Section 01 40 00 – Quality Requirements for further requirements.

2.2.1.2. Characteristics:

2.2.1.2.1. Resilient Rubber Tile Flooring

2.2.1.2.2. Complies with requirements for ASTM F 1344 Standard Specification for Rubber Floor Tile, Class 1-B.

2.2.1.2.3. Manufactured from a homogeneous composition of 100% synthetic rubber.

2.2.1.2.4. ASTM D 2240 Standard Test Method for Rubber Property-Durometer

2.2.1.2.5. Hardness: Not less than 85'Shore A.

2.2.1.2.6. ASTM D 3389 Standard Test Method for Coated Fabrics Abrasion Resistance:< 1.00 gram weight loss.

2.2.1.2.7. ASTM D 2047, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring: Exceeds Federal Standards and AODA requirements for slip resistant.

2.2.1.2.8. ASTM F 970, Standard Test Method for Static Load Limit- passes at 250 PSI.

2.2.1.2.9. ASTM E 648, Standard Test method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source - Class 1.

2.2.1.2.10. Scrap or discarded material is to be returned using Johnsonite's RESTART reclamation program.

2.2.1.2.11. SCS Global Services (SCS) FloorScore® Certified and meets California

2.2.1.2.12. Phthalate, chlorine and halogen free.

2.2.1.2.13. NSF-332 Gold Certified.

2.2.1.2.14. Johnsonite facilities are ISO 9001 and ISO 14001 Certified.

2.2.1.2.15. Possible LEED contributions for Johnsonite Microtone Rubber Flooring include MR2; MR5; and EQ4.3.

2.2.2. Provide Products free from blisters, cracks, chipped edges and corners, embedded foreign matter or other defects.

2.2.3. All Materials under Work of this section, including but not limited to, primers, and adhesives are to have low VOC content limits.

2.2.4. Concrete Moisture Emission Reducer: Provide “Flextech 300” by Flextile Ltd. or Equivalent..

2.2.5. Underlayment: Latex/cement/sand patching compound compatible with resilient flooring and associated adhesives; “Latax Filler, S-194" by Armstrong World Industries Canada Ltd., Ultra/Plan by Mapei Canada Inc., “Flextile Patch” by Flextile Ltd. or if acceptable to Product manufacturer Sureflo, hydraulic cement based self-levelling floor underlayment manufactured by Gemite Products Inc. or Equivalent.

2.2.6. Rubber Tile Flooring (RT-1): In accordance with ASTM F1344, Class 1,2 mm thick, 610 mm x 610mm (24” x 24”) “Microtone Speckled Rubber Tile” in Hammered, colour shall be ‘Wayne Manor# HNSP-LJ7’, by The Johnsonite Rubber Co. or Equivalent.

2.2.7. Resilient Sheet Flooring (RS-1):

2.2.7.1. ASTM F1913, non-backed, non-layered, homogenous vinyl composition composed of polyvinyl chloride resin, stabilizers, fillers and pigments for use on approved slab on grade and suspended floors.

2.2.7.2. Supply 2.00 mm (0.080") thick, 2.00 m (6' - 6"); “iQ Optima” in colour ‘Beluga W #886’ by Johnsonite or Equivalent.

2.2.8. Generally vulcanized PVC-free rubber base is better quality than vinyl as rubber doesn’t shrink over time whereas vinyl has the potential to shrink.

2.2.9. Resilient Base (RB): 3 mm (1/8") thick x 100 mm (4") high in accordance with ASTM F1861, Type TS, Group 1, Style B, PVC-free vulcanized rubber, in coil lengths, colour selected from manufacturer's standard range. Provide “Rubber Wall Base” by Johnsonite or Equivalent.

2.2.9.1. Flooring material to extend 102 mm (4”) onto wall surface.

2.2.10. Resilient Base (RB): 3 mm (1/8") min thick x 100 mm (4") high in accordance with ASTM F1861, Type TV, Group 1, Style B, in coil lengths, colour selected from manufacturer's standard range. Provide “Vinyl Wall Base” by Johnsonite or Equivalent.

2.2.11. Reducing Strips (RS): Vinyl, thickness to suit adjacent flooring; Johnsonite, American Biltrite (Canada) Ltd., Flexco or Roppe Corporation, USA or Equivalent.

2.2.12. Primers and Adhesives: Waterproof, as required for surfaces involved as recommended and supplied by the tile manufacturer used.

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions: Verify the actual Site dimensions and location of adjacent materials prior to commencing Work. Notify the Consultant in writing of any conditions which would be detrimental to the installation.

3.1.2. Preinstallation Testing:

3.1.2.1. Perform calcium chloride test through an independent testing organization in accordance with requirements of ASTM F1869 immediately prior to installation of resilient flooring for moisture on concrete floors around perimeter of areas, at columns and where moisture may be anticipated. Conduct 3 tests for first 93 m^2 (1000 sq ft) and 1 additional test for every 93 m^2 (1000 sq ft) of flooring. Ensure moisture emission from concrete floor does not exceed 1.36 kg/93 m^2 (3 lbs/1000 sq ft) in 24 hours unless otherwise stated in flooring Product instructions and limitations. Do not proceed with installation until moisture problem has been corrected. Provide results to the Consultant prior to commencement of installation.

3.1.2.2. When concrete moisture emission is between 1.36 kg/93 m^2 (3 lbs/1000 sq ft) and 4.53 kg/93 m^2 (10 lbs/1000 sq ft) in 24 hours use concrete moisture emission reducer.

3.1.2.3. Conduct pH test through an independent testing organization to ensure alkali salt residue is within the limitation acceptable to manufacturer and to avoid adhesive failure, discoloration, shrinkage and softening of the floor covering. If the pH results are higher than 10, report to the Consultant or the Owner for investigation and remedial. Also refer to manufacturer for ways to neutralize floor prior to beginning of installation. Neutralize by sanding, vacuuming and/or by water plus mild sulfuric or sulfamic acid application as recommended by manufacturer. Retest to assure pH has been neutralized.

3.1.3. Evaluation and Assessment: Commencement of Work implies acceptance of previously completed work.

3.2. PREPARATION

3.2.1. Surface Preparation:

3.2.1.1. Clean resilient flooring substrates free of loose and adhered material perfectly clean and in accordance with the resilient flooring manufacturer's instructions.

3.2.1.2. Perform bond test over floors where paint, varnish and other foreign agents are removed.

3.2.1.3. Ensure concrete substrates are dry after performing tests as specified herein before using methods recommended by resilient flooring and adhesive manufacturers and that they exhibit no alkalinity, carbonization, dusting or scaling.

3.2.1.4. Remove subfloor ridges and bumps to flush with adjacent subfloor.

3.2.1.5. Stripping:

3.2.1.5.1. Remove and dispose of existing resilient flooring. Remove existing adhesives and prepare substrate as recommended by resilient flooring manufacturer.

3.2.1.5.2. Test existing substrate for soundness and remove unsound substrates.

3.2.1.6. Underlayment:

3.2.1.6.1. Fill depressions, dished areas, low spots, voids, gaps, cracks, joints, holes and other substrate defects with underlayment, flat, even and flush with adjacent substrate.

3.2.1.6.2. Floor fills, toppings and underlayment shall have minimum compressive strength of 24 MPa (3500 psi). Do not install underlayment, leveler, patching and skim coat over expansion joints.

3.2.1.6.3. Provide underlayment to achieve a flat substrate to within the following tolerances:

3.2.1.6.3.1. 3 mm (1/8") total maximum deviation +/- along a 3000 mm (10') straight edge applied omni-directionally over entire floor area.

3.2.1.6.4. Provide a flat, smooth 610 mm (24") wide underlayment strip at the junction of resilient flooring with other finish flooring materials for a flush transition at the meeting edge. Feather strip edges to conceal its perimeter.

3.3. INSTALLATION

3.3.1. Scribe resilient flooring materials accurately around floor outlets, pipes, drains and projections through the floor.

3.3.2. Scribe non-coved resilient flooring materials accurately around their perimeters including at walls, columns and kickspaces of architectural woodwork.

3.3.3. Locate junctions of dissimilar flooring between rooms (i.e. same material but different colour, or different material) at door opening centrelines.

3.3.4. Provide resilient flooring flush with floor plates, cleanout covers and other fitments in the floor.

3.3.5. Do not provide resilient flooring beneath permanently concealed portions of work of Section 06 40 00 unless indicated otherwise.

3.3.6. Do not install flooring across expansion joints. Coordinate expansion joint covers for use with resilient flooring.

3.3.7. Where resilient flooring terminates at exterior doors with thresholds or transition trim, feather flooring as required to achieve maximum allowable distance of 13 mm (1/2") between flooring and top of threshold or transition trim. Extend resilient flooring a minimum of 13 mm (1/2") under threshold and apply sealant to perimeter of threshold.

3.3.8. Rubber Tile:

3.3.8.1. Spread primer evenly over floor surfaces. Permit primer to dry. Apply adhesive evenly over floor surfaces. Allow adhesive to become tacky before laying tile.

3.3.8.2. Lay tile with joints straight, in true plane, butted to moderate contact, symmetrical with and parallel to axes of rooms to provide equal size perimeter tile on each side. Distribute variations in shade or pattern to obtain a uniform effect. Abrupt variations will not be acceptable. Lay in pattern as directed by the Consultant.

3.3.8.3. Roll after laying with a polished, clean roller weighing at least 45 kg (100 lbs).

3.3.8.4. Prevent traffic over newly laid rubber tile floor for 48 hours after installation.

3.3.9. Resilient Base:

3.3.9.1. Provide resilient base to substrate surfaces in accordance with the manufacturer's recommendations.

3.3.9.2. Apply adhesive evenly and continuously for full base adhesion and contact. Do not apply adhesive in a manner which promotes induced waviness in resilient base.

3.3.9.3. Provide base in longest lengths possible with top and bottom edges installed straight and true. Provide preformed inside and outside corners.

3.3.9.4. Provide resilient bases to walls, partitions, columns and items of architectural woodwork.

3.3.10. Reducing Strips: Protect exposed edges of resilient flooring, where finished and unfinished area adjoin, by means of reducing strips butting to and flush with finished surface of floor covering material.

3.3.11. Promptly remove and replace flooring showing bumps from underlying dirt, discolouration, excessive wear, shrinkage or adhesion failure. Remove and replace base showing shrinkage or adhesion failure.

3.4. CLEANING

3.4.1. Remove adhesive from surface of flooring as Work progresses.

3.4.2. After vinyl composite tile floors have been cleaned and dried, apply 1 coat of wax of a type acceptable to Owner and polish to a hard surface with mechanical buffers. Do not wax sheet flooring.

3.4.3. Do not wash newly laid floor covering for minimum 7 Days after installation to allow adhesive to set and dry.

3.5. PROTECTION

3.5.1. Protect this Work and Work of other trades at all times.

3.5.2. Protect newly laid flooring from construction traffic for a period of 7 Days to allow flooring to bond firmly. Then thoroughly clean surfaces in accordance to manufacturer's directions using cleaners as recommended by material manufacturer.

3.5.3. Provide and maintain necessary protection of finished resilient flooring and bases. Replace damaged resilient flooring and bases with new materials without cost to the Owner.

END OF SECTION

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PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this Section.

1.2. SUMMARY

1.2.1. Section Includes: Provide carpet tile including but not limited to following:

1.2.1.1. carpet tile.

1.2.1.2. carpet base.

1.2.1.3. resilient accessories.

1.2.1.4. metal edge strips.

1.2.2. Related Sections: the following description of Work is included for reference only and shall not be presumed complete:

1.2.2.1. Supply of resilient base: Section 09 65 00 - Resilient Flooring.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. CRI: Carpet and Rug Institute; www.carpet-rug.com.

1.3.1.2. MSDS: Material Safety Data Sheets.

1.3.1.3. SCAQMD: South Coast Air Quality Management District; www.aqmd.gov.

1.3.1.4. ULC: Underwriters' Laboratories of Canada; www.ulc.ca.

1.3.1.5. VOC: Volatile Organic Compound.

1.3.2. Reference Standards:

1.3.2.1.	CAN/CGSB-4.129-93	- Carpet for Commercial Use
1.3.2.2.	CAN/ULC-S101-07	- Standard Methods of Fire Endurance Tests of Building Construction and Materials
1.3.2.3.	CAN/ULC-S102.2-07	- Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies

1.4. SUBMITTALS

1.4.1. Shop Drawings: Submit carpet tile layout Drawings in accordance with Section 01 30 00 – Administrative Requirements. Do not install carpet tile until layout Drawings have been approved.

1.4.2. Samples:

1.4.2.1. Prior to ordering carpet tile, submit samples of carpet tile and accessories to Consultant for approval, minimum 450 mm x 450 mm (18" x 18"), for each type and colour of carpet to be used.

1.4.2.2. The Consultant may take random samples of carpet tiles as installation progresses

for comparison with approved samples. If, in opinion of the Consultant, such samples fail to meet standard of approved samples, remove tiles and replace with approved tiles as required at no cost to the Owner.

1.4.3. Operational and Test Reports: Submit test reports to show Product meets Specifications.

1.5. CLOSEOUT SUBMITTALS

1.5.1. Operational and Maintenance Data: Submit maintenance instructions in triplicate for insertion in maintenance manuals in accordance with Section 01 30 00 – Administrative Requirements. Ensure instructions give specific warning of maintenance or cleaning practices or materials which may damage carpeting.

1.5.1. Extra Stock Materials:

1.5.1.1. Supply in addition to quantities required for Work, extra materials and Products to be stored by the Owner as follows:

1.5.1.1.1. Provide 20 extra boxes - unused.

1.5.1.2. Deliver extra stock to the Owner as soon as permanent, locking storage facilities are available. Place extra stock in designated storage area where directed by Owner.

1.6. MAINTENANCE MATERIAL SUBMITTAL

1.6.1. Extra Stock Materials: Deliver to the Consultant and store where directed 5% of each colours selected suitably labelled in boxes. Identify Product name, colour, quantity and locations where used in the Project (Room Name and Nos).

1.7. QUALITY ASSURANCE

1.7.1. Qualifications:

1.7.2. Installers: Provide Work of this Section executed by competent installers with a minimum of 5 years' experience in application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

1.7.3. Mock-Ups: In area designated by the Consultant, provide sample installation of each colour of at least 9 m^2 (100 sq ft) showing colour matching. Make changes as required until approved by Consultant. When approved, sample area represents minimum acceptable standard for work. Remove sample installation when directed unless sample area can be satisfactorily incorporated into Work.

1.8. DELIVERY, STORAGE AND HANDLING

1.8.1. Delivery and Acceptance Requirements: Deliver cartons of carpet tile to Site clearly tagged to show installation location.

1.8.2. Storage and Handling Requirements:

1.8.2.1. Store adhesive, carpet tapes and similar items in heated area maintained at minimum temperature of 10 deg C (50 deg F) or at such temperature as recommended by Product manufacturer.

1.8.2.2. Comply with adhesive and carpet tile manufacturer's directions for use of adhesive. Observe open time limits for adhesives and place lids on open cans when not being used. Under no circumstances contaminate or thin adhesives with water or solvents, unless specifically directed by manufacturer in writing.

1.9. SITE CONDITIONS

1.9.1. Ambient Conditions: Provide ventilation system in area to be carpeted to ensure adequate (min 1 air change each hour) extraction of VOC's or other contaminants. In occupied buildings, existing ventilation system may not be used for this purpose.

1.10. WARRANTY

1.10.1. Manufacturer Warranty: Warrant Work of this Section for a period of 2 years against defects and/or deficiencies in accordance with the General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to; buckling, opening of seams, bond failure, extensive colour fading and loss of more than 10% of pile fibre in any area.

PART 2 - PRODUCTS

2.1. MATERIALS

2.1.1. Description:

2.1.2. Carpet Tile: Provide tiles uniform in colour and texture, supplied from same dye batch, conforming to CAN/ULC-S101 and CAN/CGSB-4.129, having flame spread rating and smoke developed classification tested in accordance with CAN/ULC-S102.2 for floor surface covering and certified by ULC or WH and having following minimum properties and characteristics:

2.1.2.1. Fibre: 100% nylon fibre, antistatic (Dupont DSDN) (Dupont Antron Lumina) (and Dupont Antron Legacy) (BASF Zeftron Nylon).

2.1.2.2. Yarn Construction: 2 or 3-ply, Bulked Continuous Filament ("BCF') construction.

2.1.2.3. Method of Colouration: Space and/or solution dyed (min 50% solution dyed).

2.1.2.4. Face Weight: min 814 g/m^2 (24 oz) or 882 g/m^2 (26 oz).

2.1.2.5. Total Mass (Weight): min 4610 g/g/m^2 (136 oz/sq yd) or 4984 g/g/m^2 (147 oz/sq yd).

2.1.2.6. Carpet Construction: (level) (tip sheared) (patterned) (tip sheared patterned) (tufted patterned) (tufted tip sheared patterned) loop.

2.1.2.7. Gauge: min 1/10" gauge.

2.1.2.8. Stitch Count: 10 per inch.

2.1.2.9. Density: min 10.5 kilotex.

2.1.2.10. Tile Size: min 450 x 450 mm (18 x 18").

2.1.2.11. Carpet Backing: PVC, urethane, bitumen.

2.1.2.12. Colour: Custom colour selections may be made by the Consultant at no extra cost to the Owner.

2.1.2.13. Static Control: < 2 kilovolts at 20% relative humidity and at 21 deg C (70 deg F).

2.1.2.14. Adhesive: Non-toxic, providing total VOC emission not exceeding 0.5 mg/m^2 per hour. Vinyl-compatible, quick release adhesive recommended by carpet manufacturer.

2.1.3. CP-1 Provide 18" x 18" "Custom Applause #03064" colour shall be "#86353 Custom by Tandus or Equivalent. Installation method to be monolithic.

2.1.4. Tools: Paint roller and tray, seam roller, steel measuring tape, chalk line (use white chalk) and carpet knife.

2.1.5. Thresholds: Aluminum, screw-down type as recommended by carpet manufacturer, colours selected by the Consultant from manufacturers' standard range.

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions: Verify the actual Site dimensions and location of adjacent materials prior to commencing Work. Notify the Consultant in writing of any conditions which would be detrimental to the installation.

3.1.2. Evaluation and Assessment: Commencement of Work implies acceptance of previously completed work.

3.2. PREPARATION

3.2.1. Surface Preparation:

3.2.1.1. Ensure floor is clean and free of cracks and protrusions. Remove dirt, paint, debris, grease, oil and loose toppings or finishes.

3.2.1.2. Fill gaps or cracks more than 2 mm (1/16") wide and minor depressions with Latex compound. Grind protrusions smooth.

3.2.1.3. Vacuum clean floors prior to installation.

3.3. INSTALLATION

3.3.1. Commencement of Work: Refer to the Drawings and Room Finish Schedule for areas where carpet is to be installed. Install the Work of this Section after all Subcontractors have completed their Work and just prior to completion of the Work, unless otherwise instructed by the Consultant.

3.3.2. Measuring: Determine centre of room using standard tile-laying methods. Resulting quadrants should meet at right angles. Offsetting centre chalk line may become necessary to insure that perimeter tiles will be at least half-size or larger.

3.3.3. Pile Direction: Install carpet tiles to achieve monolithic appearance with arrows on back pointing in same direction.

3.3.4. Laying Out: To prevent movement of tiles during initial stages and to insure straight lines and square corners, create an anchor line by laying strips of adhesive alongside each centre chalk line. Lay tiles accurately and firmly along centre lines in selected quadrant. Additional tiles within quadrant should be installed by "stair-step" technique. In some cases, due to partitions, "starting" point is centre of the room. Carpet tiles are to be installed up to partitions, not under partition.

3.3.5. Checking Tightness: Measure areas to insure tight installation. Measure over 11 tiles to attain cumulative space "gained" over 10 joints. The gain must not be greater than 6 mm (1/4"). Utilize this method in continual check of installation.

3.3.6. Alignment: As tiles are butted against each other, frequently check at joints with your fingers to see that they are properly aligned. Do not install tiles that seem out of true more than 1.5 mm (1/32").

3.3.7. Control Grid: To prevent tiles from shifting in larger areas, about every 6 m (20') to 9 m (30') both in length and width directions, anchor row of tiles. Use texturing paint roller to apply narrow strip of adhesive under "control" tiles.

3.3.8. Joints: Take care when butting 1 tile against another. Avoid too much pressure on joining tiles, as it will

cause tiles to "peak" or "buckle". Face pile should be brushed back and tile "tipped" into place, to avoid any pile being caught in joint.

3.3.9. Perimeter Tiles: Adhere to floor unless noted on the Drawings. Lay last whole tile closest to wall and perimeter cuts on adhesive. Perimeter cuts must then be accurately cut and tightly fitted against vertical fixed surface such as wall. In event of an open perimeter design, a fixed reducer strip anchored to floor is necessary to lock tile area in place.

3.3.10. Cutting: Cuts are best made from back, whether using template for fitting around columns or at room perimeter. Activation of electrical floor outlets will follow carpet installation. Affected tiles must be surface-marked with tape.

3.3.11. Trimming and Gluing: Whenever tile is cut or trimmed, it must always be adhered to floor.

3.4. SITE QUALITY CONTROL

3.4.1. Non-Conforming Work: Replace damaged Work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of the Consultant at no cost to the Owner.

3.5. CLEANING

3.5.1. Immediately following installation, inspection and approval of Work by the Consultant, vacuum clean carpet using pile lifter and remove debris.

3.5.2. Waste Management: Comply with Government of Ontario Waste Management requirements. Ensure surplus tile and waste is accumulated daily and at completion of Work remove such materials to suitable recycling facility. Where Work of Contract is for replacement of existing carpet, ship removed carpet to suitable recycling facilities.

3.6. PROTECTION

3.6.1. Restriction of Traffic: Restrict traffic during installation. Upon completion of installation, do not allow traffic or movement of furniture onto carpet surface until installed area has been anchored at perimeter.

3.6.2. Cover entire carpeted area with plastic covering held in place by masking tape at seams and stay- tacking around perimeter, if required by the Consultant.

3.6.3. Do not remove carpet protection until directed by the Consultant.

3.6.4. Hand over work to the Owner free of blemishes and in perfect condition.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to in this Section.

1.2. SUMMARY

1.2.1. Section Includes: Provide painting including but not limited to following:

1.2.1.1. surface preparation of substrate: abrasive blasting, cleaning and preparation of surfaces for application of paint systems.

1.2.1.2. interior priming and painting of:

1.2.1.3. exterior or interior sealing, staining and coating of:

1.2.1.3.1. gypsum board ceiling.

1.2.1.3.2. Doors and Frames

1.2.1.4. provision of materials, labour and equipment required to complete painting Work and ancillary Work described and implied herein to full intent of the Drawings and Schedules.

1.2.1.5. waste management and disposal of paint, stain and wood preservatives and other related hazardous materials.

1.2.2. Section Excludes:

1.2.2.1. Painting of:

1.2.2.1.1. pre-finished metal siding, fascia and soffit, coping cap flashing and similar components. Refer to dedicated Specification Sections for special finishes and their effects on the Work of this Section.

1.2.2.1.2. chrome, stainless steel, vinyl, plastic laminate and aluminum surfaces throughout unless specified otherwise on the Drawings.

1.2.2.1.3. internal surfaces of steel tanks and stacks.

1.2.2.1.4. sprayed fire-resistive materials.

1.2.2.1.5. wallcoverings.

1.2.2.1.6. primed and finish painted equipment furnished by manufacturer unless required to be field painted in 1 common corporate colour as identified in finish schedule.

1.2.3. Related Sections: Following description of Work is included for reference only and shall not be presumed complete:

1.2.3.1. Wood preservative or fire retardant treatment for rough carpentry: Section 06 10 00 - Rough Carpentry.

1.2.3.2. Priming and/or back painting of wood: Section 06 10 00 - Rough Carpentry.

1.2.3.3. Coordination of paint for application on suspended acoustic ceilings: Section 09 51 00 - Acoustic Tile Ceilings.

1.2.3.4. Instructions on painting, stenciling and banding of mechanical and electrical Work: Division 22, Plumbing, Division 23, Heating, Ventilating and Air Conditioning and Division 26, Electrical.

1.2.3.5. Factory assembled pre-finished roof mounted air handling and air conditioning equipment: Division 23, Heating, Ventilating and Air Conditioning.

1.2.3.6. Prime and finish coats applied by other Sections. Read carefully other Sections of Specifications to determine extent thereof.

1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. DFT: Dry Film Thickness.

1.3.1.2. MPI: The Master Painters Institute; www.mpi.net.

1.3.1.3. MSDS: Material Safety Data Sheets.

1.3.1.4. OPCA: Ontario Painting Contractors Association; www.ontpca.org.

1.3.1.5. SCAQMD: South Coast Air Quality Management District; www.aqmd.gov.

1.3.1.6. SRA: Slip Resistant Additive

1.3.1.7. SSPC: The Society for Protective Coatings (formerly known as Steel Structures Painting Council); www.sspc.org.

1.3.1.8. TSP: Tri-sodium Phosphate.

1.3.1.9. ULC: Underwriters' Laboratories of Canada; www.ulc.ca.

1.3.1.10. VOC: Volatile Organic Compound.

1.3.2. Definitions:

1.3.2.1. Exposed: Visible in completed Work. In case of closets, cabinets and drawers, it includes their interiors. Exposed surfaces in underground parking areas are considered "Exterior" for purpose of this Contract. Exposed surfaces in aboveground parking areas are considered "Interior" for the purpose of this Contract.

1.3.2.2. Hazardous Waste: Construction and demolition materials that are regulated for disposal by local, city, county, province or federal Authorities Having Jurisdiction.

1.3.2.3. Gloss or Sheen: Capacity of a finish on a surface to reflect light at specific angles as tested in accordance with ASTM D523. Following are gloss or sheen types as defined by MPI:

1.3.2.3.1. Flat (G1): Lusterless or matt finish.

1.3.2.3.2. Velvet (G2): High side flat sheen finish.

1.3.2.3.3. Eggshell (G3): Low sheen finish.

1.3.2.3.4. Satin (G4): Low-medium sheen finish.

1.3.2.3.5. Semi-Gloss (G5): Medium sheen finish.

1.3.2.3.6. Full Gloss (G6): High sheen finish.

1.3.2.3.7. High Gloss (G7): Ultra high sheen finish.

1.3.2.4. Painting: In this Section refers to application of various types of paint, stain, varnishes and lacquers, etc.

1.3.2.5. Surface Preparation: Cleaning or treating of surface to be painted to ensure best possible bond between surface and painting to be applied to surface; remove surface contaminants that will affect performance of painting, without limitations such as oil, grease, salts, dust, dirt, rust, rust scale, mill scale and old coatings where applicable; remove surface imperfections without limitation including but not limited to such as weld spatter, sharp edges, burrs, slivers, laminations, pits, porosities and crevices; prepare surfaces to provide anchor profile or surface profile which improve mechanical bonding of coating to prepared surface by increasing surface area.

1.3.3. Reference Standards:

1.3.3.1.	ASTM D523-89(08)	- Standard Test Method for Specular Gloss
1.3.3.2.	CAN/CGSB-1.500-75	- Methods of Test of Toxic Trace Elements in Protective Coatings
1.3.3.3.	CAN/CGSB-85.100-93	- Painting
1.3.3.4.	MPI Painting Manual-07	- The Master Painters Institute – Architectural Painting Specification Manual by PDCA
1.3.3.5.	MPI Approved Products List-09	– The Master Painters Institute – Approved Products List (Includes United States, Canada and International Editions), 2009
1.3.3.6.	SSPC-05	- Systems and Specifications - Steel Structures Painting Manual, Volume 1 & 2

1.4. ADMINISTRATIVE REQUIREMENTS

1.4.1. Pre-installation Meetings:

1.4.1.1. Review the Drawings, details and Schedules, determine intent, extent, materials, types of surfaces, locations and be fully cognizant of intent of Work. Review Product literature, MSDS, related safety data, proper disposal requirements and inform those involved in Work of this Section.

1.4.1.2. Review Specifications and Drawings for the Work of other Sections regarding provisions for prime and finish coats and ensure compatibility with each other and substrate prior to application.

1.4.1.3. Prior to start of Work, arrange for the project Site meeting of parties associated with the Work of this Section. Presided over by the Contractor, include the Consultant, Subcontractor, manufacturer's representative, any Subcontractors whose Work will be painted (including mechanical and electrical Subcontractors) or whose Work is adjacent to, or whose Work or schedule may be affected by the Work of this Section.

1.4.1.4. Review Specification for the Work included under this Section and determine complete understanding of requirements and responsibilities relative to Work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, the project staffing, restrictions on areas requiring painting and other matters affecting

construction, to permit compliance with intent of this Section.

1.4.2. Scheduling:

1.4.2.1. Painting Schedule: Provide within 30 Days of award of the Contract, together with proposed manufacturer of materials to be used, a Schedule comprised of locations, types of surfaces, types of painting materials (and manufacturer's names) and number of coats to be used.

1.4.2.2. Schedule painting operations to prevent disruption of and by other trades. Ensure painting is completed for locations requiring application of finishes by other trades in a timely fashion to prevent delays.

1.4.2.3. Schedule painting operation in occupied facilities to prevent disruption of occupants in and about the Project. Carry out painting during working hours in accordance with the Owner's operation requirements. Schedule Work such that painted surfaces will have dried before occupants are affected. Obtain written authorization from the Consultant or the Owner for changes in Work schedule.

1.5. SUBMITTALS

1.5.1. Product Data:

1.5.1.1. Submit Product data conforming to Section 01 70 00 – Execution and Closeout Requirements and submit a Schedule of Finishes listing manufacturer's Product name, colour, textures, MSDS and test reports requested for each paint system. Submit test reports for odourless, low or zero VOC Products when specified.

1.5.1.2. Painting Subcontractor shall receive written confirmation of specific surface preparation procedures and primers used for fabricated steel items from fabricator/supplier to ensure appropriate and manufacturer compatible finish coat materials prior to commencement of painting.

1.5.1.3. Painting Subcontractor shall receive written Product data regarding chemical composition of coatings or treatments applied by others (pressure preservatives, admixtures and sealers etc.) and their paintability.

1.5.1.4. Submit Product data for concrete and concrete block primers.

1.5.2. Samples: Submit samples 30 Days before materials are required in accordance with Section 01 30 00 - Administrative Requirements. Submit following samples in sizes indicated:

1.5.2.1. 2 copies of brushouts minimum 200 mm x 250 mm (8" x 10") of each finish including colour, sheen and texture required at least 30 Days prior to commencement of application. Identify each sample with job, finish, colour name, number, sheen and gloss values, substrate to be applied to, date and name of Subcontractor.

	Substrate	**Sample, Base Material**
1.5.2.1.1.	Gypsum Board	Face of typical unit
1.5.2.1.2.	Doors and frames	face of typical unit

1.5.2.2. Sample panels of stain, varnish, lacquer or other wood finish on each species of wood specified, minimum 300 mm (12") square and of specified thickness.

1.5.3. Certificates:

1.5.3.1. Surface Preparation: Submit manufacturer's representative's written approval of surface preparation methods and any specific recommendations for alternative methods.

1.5.3.2. Materials: Submit list of proposed materials prepared by paint manufacturer, for approval at least 60 Days before materials are required. Ensure list bears manufacturer's official certification that materials listed meet or exceed requirements specified herein, are compatible with respective substrates and primer coats, including those applied by the Work of other Sections.

1.5.4. Site Quality Control Submittals:

1.5.4.1. Submit Site instruction reports in accordance with Section 01 30 00 – Administrative Requirements containing information required by this Section.

1.5.4.2. Progress Reports:

1.5.4.2.1. Submit in accordance with Section 01 30 00 – Administrative Requirements.

1.5.4.2.2. Arrange to have paint manufacturer's representative inspect Work of this Section on a regular basis and prepare weekly job progress reports. Submit copy of reports to the Consultant.

1.5.5. Operation and Maintenance Data: Submit 4 copies of list of materials used, together with MSDS for each Product for incorporation into maintenance manuals. Include maintenance information such as cleaning and full pigment information for future touch up.

1.6. MAINTENANCE MATERIAL SUBMITTALS

1.6.1. Extra Stock Materials: Submit to the Owner 4 extra litres of the field colour and 1 extra litre of the trim colour can of each different type and colour and degree of gloss of paint used (batch mix) on this Project for touch-ups. Ensure paint is boxed and in sealed, unopened cans in undamaged condition, with name of manufacturer, contents, type and colour clearly indicated on a label securely adhered to can. Give to the Consultant at time of final inspection.

1.7. QUALITY ASSURANCE

1.7.1. Qualifications:

1.7.1.1. Applicators:

1.7.1.1.1. Execute the Work of this Section by a firm which has adequate plant, equipment and skilled workers to perform Work expeditiously and which is known to have been responsible, during immediate past 5 years, for installations similar to Work contained herein. Firm to be fully conversant with applicable laws, bylaws, codes, fire, health and safety regulations and other regulations which govern.

1.7.1.1.2. Provide the Work of this Section executed by competent applicators who have a minimum of 5 years' experience in application of the Products, systems, coatings and assemblies specified and with approval and training of Product manufacturers.

1.7.1.1.3. Ensure materials, preparation and workmanship conforms to requirements of MPI Painting Manual.

1.7.2. Certifications: Ensure paint manufacturers and Products used are listed under Approved Product List section of MPI Painting Manual.

1.8. DELIVERY, STORAGE AND HANDLING

1.8.1. Delivery and Acceptance Requirements:

1.8.1.1. Deliver to the Site, materials manufacturer's original, sealed and labeled containers bearing manufacturer's name, brand name, type of paint or coating and colour designation, degree of gloss, batch number, standard compliance, materials content as well as mixing, reducing and application requirements.

1.8.1.2. Manufacturer to certify, materials delivered to site conform to approved list and are of top quality Product range.

1.8.2. Storage and Handling Requirements:

1.8.2.1. Store on the Site, materials in manufacturer's sealed and labeled containers.

1.8.2.2. Comply with applicable local fire and building code requirements during storage and application.

1.8.2.3. Store containers of paint, thinner and other volatile materials in secure, well ventilated location, heated to minimum 10 deg C (14 deg F), where they will not be exposed to excessive heat or direct solar radiation. Keep tightly closed when not in actual use.

1.8.2.4. Presence of any unauthorized materials or containers on Site is sufficient cause for rejection of paint materials on the Site at that time.

1.8.2.5. Protect floor and wall surfaces in storage areas from paint drips and splatters.

1.8.2.6. Be totally responsible for prevention of fire or explosion caused by improper storage of paints, solvents, rags and similar items. Store fire hazardous materials in location and in manner approved by local fire authority. Post "No Smoking" signs in areas of storage and mixing and strictly enforce this requirement. Provide and maintain CO2 fire extinguishers of minimum 9 kg (20 lb) capacity. Repair damage to storage area or surrounding area at no cost to the Owner.

1.8.2.7. Where toxic, volatile, explosive, flammable materials are used, provide adequate fireproof storage lockers and take necessary precautions and post adequate warnings (e.g. "No Smoking" signs) as required.

1.8.3. Packaging Waste Management: Leave storage areas clean and free from evidence of occupancy. Dispose of packaging in appropriate method as required by Authorities Having Jurisdiction, and in an environmentally responsible manner in accordance with LEED® guidelines and local requirements.

1.9. SITE CONDITIONS

1.9.1. Ambient Conditions:

1.9.1.1. Paint and finish in clean, dust-free, properly ventilated and adequately lit areas minimum 323 Lx (30 ft candles) on surfaces to be painted or decorated.

1.9.1.2. Provide each paint materials in accordance with the manufacturer's recommended tolerances for:

1.9.1.2.1. Substrate Moisture Content: Perform tests with a properly calibrated electronic moisture meter to ensure compliance with manufacturer's recommendations. Without limitation, maximum moisture content as follows:

1.9.1.2.1.1. Gypsum Based Board and Plaster: Maximum 12 - 14%.

1.9.1.2.1.2. Wood: Maximum 15%.

1.9.1.3. Temperature and Ventilation:

1.9.1.3.1. Do not provide paint under ambient and surface temperatures less than those required below in any instance for 24 hours before, during and 7 Days after installation.

1.9.1.3.2. Provide ventilation to remove odours, evaporating solvents and moisture. Maintain adequate ventilation at all times to control excessive humidity.

1.9.1.3.3. Ensure adequate temporary ventilation is provided under Section 01 50 00 - Temporary Facilities and Controls for protection of workers from toxic fumes.

1.9.1.3.4. Interior Paint:

1.9.1.3.4.1. Water Based Paints: Maintain minimum interior surface and ambient air temperature of between 18 deg C (65 deg F) and 32 deg C (90 deg F) during application and drying of paint and maintain until building occupancy occurs.

1.9.1.3.4.2. Solvent Based Paints: Maintain minimum interior surface and ambient air temperature of between 7 deg C (45 deg F) and 35 deg C (95 deg F) during application and drying of paint and maintain until building occupancy occurs.

1.9.1.3.4.3. Do not undertake interior painting on surfaces where condensation has or will form due to presence of high humidity and lack of proper ventilation.

1.9.1.3.5. Exterior Paint:

1.9.1.3.5.1. Do not undertake exterior painting if air and surface temperature are expected to fall below 10 deg C (50 deg F) before coating has dried. Avoid painting during winds, weather conditions which may affect paint application or following rain. Wait until frost, dew or condensation has evaporated. Avoid painting surfaces exposed directly to hot summer sun.

1.9.1.3.5.2. Do not apply paint in snow, rain, fog or mist or when relative humidity exceeds 85% or dew point is less than 3 deg C (5 deg F) difference between air and surface temperature, or damp or wet surfaces unless surface to be painted is enclosed and conditioned to required temperatures and ambient conditions required for application.

1.9.1.3.5.3. Where required, suitable weatherproof covering and sufficient heating facilities are to be provided which will enable required ambient and surface temperatures.

1.10. WARRANTY

1.10.1. Manufacturer Warranty: Warrant the work of this Section for a period of 2 years against defects and/or deficiencies in accordance with Article A-6 of the Contract and GC 37 of the General Conditions of the –Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of the Consultant and at no expense to the Owner. Defects include but are not limited to material and workmanship defects such as: improper cleaning and preparation of surfaces, entrapped dust and dirt, material shrinkage, cracking, splitting and defective workmanship including but are not limited to failure in bubbling, drips, runs, blistering, uneven coverage, misses, poor cutting in and delamination.

PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Manufacturer List: Products of following manufacturers are acceptable subject to conformance to requirements of the Drawings, Schedules and Specifications:

2.1.1.1. Benjamin-Moore & Co., Limited; www.benjaminmoore.com

2.1.1.2. Dulux PPG www.dulux.com

2.1.1.3. Para Paints; www.para.com

2.1.1.4. Pittsburgh Paints; www.pittsburghpaints.com

2.1.1.5. The Sico Inc. Company; www.sico.com

2.1.1.6. The Sherwin-Williams Company; www.sherwin-williams.com

2.1.1.7 Or Equivalent

2.1.2. Source Limitations: Provide primers for each coating system from same manufacturer as finish coats.

2.2. MATERIALS

2.2.1. Description:

2.2.1.1. Regulatory Requirements:

2.2.1.1.1. Provide a Pre-Start Health and Safety Review in accordance with *Occupational Health and Safety Act,* R.S.O. 1990, c. O.1*)*, Regulation 851, Industrial Establishments, as amended. Refer to Section 01 40 00 – Quality Requirements for further requirements.

2.2.1.1.2. Conform to latest edition of Industrial Health and Safety Regulations issued by applicable Authorities Having Jurisdiction in regard to Site safety (ladders, scaffolding, ventilation, etc.)

2.2.1.1.3. Comply with more stringent of applicable laws, bylaws, codes, fire regulations, health and safety regulations of Authorities Having Jurisdiction or requirements of this Specification. Ensure standards used for Work of this Section is considered a minimum.

2.2.1.1.4. Where required, ensure paints and coatings meet flame spread and smoke developed ratings designated by local code requirements and/or Authorities Having Jurisdiction.

2.2.1.1.5. Comply with toxic trace limitations stipulated by Authorities Having Jurisdiction as tested in accordance with CAN/CGSB-1.500.

2.2.1.1.6. Conform to requirements of local Authorities Having Jurisdiction in regard to storage, mixing, application and disposal of paint and related waste materials. Refer to requirements in Section 01 50 00 – Temporary Facilities and Controls.

2.2.2. Performance/ Design Criteria:

2.2.2.1. Provide best practices specified or recommended in CAN/CGSB-85.100 and MPI Painting Manual.

2.2.2.2. The Consultant reserves right to refuse any paint or finishing material if in his/her opinion it is not suitable or adequate for proposed use.

2.2.2.3. Provide paint and finishing materials of highest grade, top quality line of Products from manufacturer. Paint material containers not displaying manufacturer's Product identification will not be acceptable. Ensure paint is not diluted.

2.2.2.4. Use brand of paint chosen throughout the Work of this Section. As far as practical, factory mix paint for immediate application without thinning or alteration at Site.

2.2.2.5. Provide primers in recommended DFT/coat.

2.2.2.6. Provide other materials such as linseed oil, shellac, thinners, solvents, etc. of highest quality Product of an MPI listed manufacturer and be compatible with paint materials being used as required.

2.2.3. Finishes:

2.2.3.1. Typical Paint PT1:

2.2.3.1.1. Manufacturer: Dulux PPG Color: 70YY 83/037(A0071) Color name: Wedding White Finish: Eggshell or Equivalent.

2.2.3.2. Doors and Frames Paint PT2:

2.2.3.2.1. Manufacturer: Dulux PPG Color: 1OYY 54/034(A1782) Color name: Roma Haze Finish: Semi-Gloss or Equivalent.

2.2.3.3. Accent Paint PT3:

2.2.3.3.1. Manufacturer: Dulux PPG Color: #90BG 17/090 Color name: Connecticut Blue Finish: Eggshell or Equivalent.

2.2.3.4. GWB Ceiling Paint PT4:

2.2.3.4.1. Manufacturer: Benjamin Moore Ceiling Paint Color: 2126-70 Color name: Chalk White Finish: Flat or Equivalent.

2.2.4. Paint materials shall have good flowing and brushing properties and shall dry or cure free of blemishes or sags. .

2.2.5. Where required, paints and coatings shall meet flame spread and smoke developed ratings designated by building code requirements and/or Authorities Having Jurisdiction.

2.2.6. Paint finishes shall be as selected by the Consultant. Locations as indicated or scheduled in the Contract Documents.

2.2.7 Colours: Prior to beginning painting Work, Subcontractor will be furnished with copy of colour schedule. Colours as selected by the Consultant.

2.2.8. Gloss /Sheen Ratings

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

2.2.8.1.1. Flat (G1): Lusterless or matt finish.

2.2.8.1.2. Velvet (G2): High side flat sheen finish.

2.2.8.1.3. Eggshell (G3): Low sheen finish.

2.2.8.1.4. Satin (G4): Low-medium sheen finish.

2.2.8.1.5. Semi-Gloss (G5): Medium sheen finish.

2.2.8.1.6. Full Gloss (G6): High sheen finish.

2.2.8.1.7. High Gloss (G7): Ultra high sheen finish.

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions:

3.1.1.1. Do Work only when surfaces and conditions are satisfactory for production of quality Work. Report to the Consultant in writing any surfaces which are found to be unsatisfactory.

3.1.1.2. Ensure temperature of surfaces to be finished are as required for application of finish. Refer to “Temperature and Ventilation” article specified herein. Ensure surfaces are dry and free of dirt, grease or other contaminants that may affect applied finish.

3.1.1.3. Verify moisture content of surfaces with electronic moisture meter. Do not proceed without written directions if moisture reading is higher than as required for application. Refer to “Ambient Conditions” article specified herein for substrate moisture content requirements.

3.1.1.4. If substrate is steel, do not apply coatings over moisture or when surface temperature is within 3 deg C (5 deg F) of dew point.

3.1.1.5. If substrate is wood, do not stain or paint if moisture reading is higher than 15%. Inspect Work to assure surfaces are smooth, free from machine marks and nail heads have been countersunk.

3.1.1.6. If substrate is cast-in-place concrete, allow to cure for 60 to 90 Days before proceeding with priming.

3.1.1.7. If substrate is precast prestressed concrete, inspect and accept or reject filled-in surface blow holes.

3.1.1.8. If substrate is new plaster or masonry, allow to cure for 30 to 90 Days. Ensure moisture content is between 12% and 14% and test for alkalinity and neutralize (pH 6.5 - 7.5) before proceeding with priming.

3.1.1.9. If substrate is gypsum board, inspect to ensure joints are completely filled and sanded smooth. Inspect surfaces for "nail popping", screw heads not recessed and taped, breaks in surface or other imperfections and have repaired as required.

3.1.1.10. Verify each substrate is dry and not frozen and free from tool and sandpaper marks, dust, rust, insects, grease and other foreign matter liable to impair finished Work.

3.1.2. Evaluation and Assessment:

3.1.2.1. Prior to commencement of Work of this Section, ensure the Subcontractor thoroughly examines (and tests as required) conditions and surfaces scheduled to be painted and reports in writing to the Contractor and Consultant any conditions or surfaces that will adversely affect Work of this Section.

3.1.2.2. Do not commence painting Work until adverse conditions and defects have been corrected and surfaces and conditions are acceptable to the Subcontractor

3.1.2.3. Commencement of Work does not imply acceptance of surfaces except as qualified in this Section. Such surfaces as concrete, masonry, structural steel and miscellaneous metal, wood, gypsum board and plaster, are not responsibility of a Subcontractor responsible for the Work of this Section. Commencement of Work implies acceptance of previously completed work.

3.2. PREPARATION

3.2.1. Protection of In-Place Conditions:

3.2.1.1. Provide scaffolding, staging, platforms and ladders, as required for execution of Work. Erect scaffolding to avoid interference with Work of other trades. Comply with the *Occupational Health and Safety Act,* R.S.O. 1990, c. O.1..

3.2.1.2. During the Work of this Section, provide drop cloths, plastic, plywood or metal sheets to protect floors in areas assigned for storage and mixing of paints. Cover finished floors, walls, ceilings and other Work in vicinity and protect from paint and damage.

3.2.1.3. Protect Work of other trades against paint splattering and Make Good at own expense any such damage.

3.2.1.4. Protect exterior surfaces and areas, including landscaping, walks, drives, adjacent building surfaces (including glass, aluminum surfaces, etc.) and equipment and any door and frame labels and signage from painting operations and damage by drop cloths, shields, masking, templates, or other suitable protective means and Make Good any damage caused by failure to provide such protection at own expense.

3.2.1.5. Remove and securely store miscellaneous and finish hardware and surface fittings, electrical switch and outlet covers, receptacle plates, louvres, fittings and fastenings, to protect from paint splatter. Mask items not removable. Use sufficient drop cloths and protective coverings for full protection of floors, furnishings, mechanical, electrical and special equipment, other components of building which do not require painting or to be removed, from paint spotting and other soiling. Carefully clean and re-install items when paint is dry. Clean any components that are paint spotted or soiled. Do not use solvent or reactive cleaning agents on items that will mar or remove finishes (e.g. lacquer finishes).

3.2.1.6. Prohibit traffic, where possible, from areas where painting is being carried out and until paint is cured. Post “wet paint” or other warning signage during and on completion of Work. Provide also warning signs at points of entry to areas where painting is applied and drying.

3.2.2. Surface Preparation:

3.2.2.1. Prepare defective surfaces to obtain a satisfactory substrate and in accordance with paint manufacturer's instructions.

3.2.2.2. Ensure exterior Work is not performed during or immediately following rain, frost or dew.

3.2.2.3. Prior to painting, sweep areas dust-free.

3.2.2.4. Clean soiled surfaces to be painted.

3.2.2.5. Remove efflorescence, chalk, dust, dirt, oil, grease, rust, form oil, release agents, loose mill scale and other extraneous matter from surfaces (except rust occurring on items specified to be primed under other Sections be removed and work re-primed under those Sections). Vacuum insulation covering surfaces. Vacuum floors clean before painting; wipe clean adjacent surfaces and surfaces to be painted before Work is commenced to prevent dust and debris damage to wet paint.

3.2.2.6. Remove mildew by scrubbing affected area with solution of 150 g (5.3 oz) TSP and 125 g (4.4 oz) bleach in 3.5 l (0.92 gal) water. Rinse well with clean water and allow to dry. If condition is serious, source out finishes with extra mildew resistance.

3.2.2.7. Be responsible for surface preparation to suit surface condition and conform to level of cleaning based on SSPC recommended metal cleaning procedures most commonly used to suit Site conditions.

3.2.2.7.1. Woodwork for Clear Finish or Stain: Sand smooth woodwork to be finished using 150 grit paper followed by a second sanding using 220 grit paper and clean surfaces free of dust using brush, compressed air or tack rags before applying first coat. Abrade surfaces with stiff brush to remove loose fibers and splinters. Fill nail holes, splits and scratches with non-shrinking filler tinted to match local grain condition after first coat is dry. Sand lightly between coats with No. 220 sandpaper and remove dust.

3.2.2.7.2. Remove salt deposits that may appear on wood surfaces treated with fire retarder.

3.2.2.7.3. Wood Doors: Remove doors before painting to paint bottom and top edges and re-hang once dry. Paint or finish top and bottom edges of doors to be painted or stained. Touch-up or refinish tops and edges after fitting.

3.2.2.8. Previously Finished Surfaces: Clean existing interior and exterior surfaces to be repainted or varnished to provide bond. Remove rust, scale, oil, grease, mildew, chemicals and other foreign matter. Remove loose paint and fill flush with suitable patching material. Clean off bubbled, cracked, peeling or otherwise defective paint by stripping with suitable environmental strippers or by burning. Do not burn off paints suspected of having lead content. Treat residue from stripping as Hazardous Waste. Flatten gloss paint and varnish with sandpaper and wipe off dust. If previous coatings have failed so as to affect proper performance or appearance of coatings to be applied, remove previous coatings completely and prepare substrates properly and refinish as specified for new work. Leave entire surface suitable to receive designated finishes and in accordance with finish manufacturer's instructions.

3.2.2.9. Gypsum Board:

3.2.2.9.1. Examine and ensure gypsum board surfaces are without defects or deficiencies and suitable to receive painting applications. Commencement implies acceptance of gypsum board Work. Examine surfaces after for imperfections showing through and fill small nicks or holes with patching compound and sand smooth. Examine surfaces after priming for imperfections showing through.

3.2.2.9.2. Clean surfaces dry, free of dust, dirt, powdery residue, grease, oil, wax or any other contaminants. Sand and dust as necessary prior to painting and between coats to provide an anchor for next coat and to remove defects visible from a distance up to 1 m (39”).

3.2.2.10. Fire Resistive Coatings: Coordinate with coating manufacturer for surface preparation requirements to ensure proper adhesion of finish.

3.3. APPLICATION

3.3.1. Safety Precautions: When handling solvent coating materials, wear approved vapour/particulate respirator as protection from vapors. Dust respirators do not provide protection from vapours.

3.3.2. Material Compatibility: Provide primers and finish coat materials compatible with each other and substrate including fillers.

3.3.3. Mixing and Tinting:

3.3.3.1. Unless otherwise specified in this Section paint to be ready and factory tinted. Re- mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment and colour and gloss uniformity.

3.3.3.2. Mix and prepare paint materials including paste, powder or catalyzed paint mixes in strict accordance with manufacturer's directions for particular material and coat to be applied to produce a mixture of uniform density. If reducing is required, do so in accordance with recommendations of manufacturer for particular material and coat.

3.3.3.3. Where thinner is used, addition is not to exceed manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

3.3.3.4. Mix primer-sealer with a certain amount of colour coat in proportions recommended by manufacturer of material actually used. Tint undercoats and each finish coat with correct type colours, for identification of each succeeding coat.

3.3.3.5. Thoroughly mix materials before application. Apply materials evenly, under adequate illumination, free from sags, runs and other defects. Do cutting-in neatly.

3.3.4. Obtain colour chart giving colour schemes and gloss value for various areas from the Consultant. Ensure colour chart gives final selection of colours and surface textures of finishes and whether finishes are transparent (natural) or opaque (paint).

3.3.5. Provide finish uniform in sheen, colour and texture, free from streaks, shiners and brush or roller marks or other defects.

3.3.6. Apply materials in accordance with manufacturer's directions and specifications paying particular attention to appropriate time frame after cleaning when environmental conditions encourage flash- rusting, rusting, contamination or manufacturer's paint specifications require earlier applications. Do not use adulterants. Do any reduction of coating's viscosity in accordance with manufacturer's directions.

3.3.7. Use paints within period of shelf life recommended by paint manufacturer.

3.3.8. Ensure successive coatings are harmonious chemical compositions and materials of same manufacturer.

3.3.9. Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1 m (39").

3.3.10. Ensure each coat is dry and hard before a following coat is applied.

3.3.11. Continue through paint finish behind wall-mounted items (e.g. chalk and tack boards).

3.3.12. Finish listed surfaces indicated on the Drawing(s) and as specified in the Contract Documents. Refer to the Drawings for type, location and extent of finishes required and include all touch-ups and field painting necessary to complete Work shown, scheduled or specified.

3.3.13. Finishes and number of coats specified in this section are intended as minimum requirements guide only. Refer to manufacturer's recommendations for exact instructions for thickness of coating to obtain optimum coverage and appearance. Some materials and colours may require additional coats and deeper colours may require use of manufacturers' special tinted primers. Provide Premium Grade finish as defined by MPI as minimum finish.

3.3.14. Paint entire plane of areas exhibiting incomplete or unsatisfactory coverage and of areas which have been cut and patched. Patching is not acceptable. Vary each coat slightly in successively darker tones to permit supervision identity.

3.3.15. Do not paint baked paint surface, chrome plated, stainless steel, aluminum or other surfaces finished with final finish in factory. Finish paint primed surfaces.

3.3.16. Advise the Consultant when each applied paint coat can be inspected. Do not recoat without inspection. Tint each coat slightly to differentiate between applied coats.

3.3.17. Apply additional paint coats, beyond number of coats specified for any surface, to completely cover and hide substrate and to produce a solid, uniform appearance.

3.3.18. Apply primer coat soon after surface preparation is completed to prevent contamination of substrate.

3.3.19. Primer/Sealers: Apply primer-sealer coats by brush or roller. Permit to dry in accordance with manufacturer's recommendations before applying succeeding coats. Touch up suction spots and sand between coats with No. 120 sandpaper.

3.3.20. Metals: Apply primer coat to unprimed ferrous metal surfaces. Where sandblast preparation is specified, apply specified primer immediately after blast cleaning.

3.3.21. Woodwork:

3.3.21.1. Fill open grain woods with filler tinted to match wood and work well into grain. Wipe excess from surface before filler sets.

3.3.21.2. Sand smooth paint and varnish undercoats prior to recoating.

3.3.21.3. Prime woodwork designated for painting as soon as possible after delivery to site and before installation. Prime cut surfaces, whether exposed or not, i.e. 6 edges of wood doors, before installation. Prime cut surfaces of woodwork to receive transparent finish with 1 coat of transparent finish reduced 25% or as directed by manufacturer.

3.3.21.4. Apply final coats on smooth surfaces by roller or brush. Hand brush wood trim surfaces.

3.3.22. Allow each coat of paint to cure and become dry and hard before application of succeeding coats (unless manufacturer's directions require otherwise).

3.3.23. Before finishing paint coats are applied, inspect and touch-up shop coats of primers previously applied by other Subcontractors or fabricators.

3.3.24. Provide paint coating thicknesses indicated, measured as minimum DFT.

3.3.25. Apply a minimum of 4 coats of paint where deep or bright colours are used to achieve satisfactory results.

3.3.26. Ledges: Finish projecting ledges, both above and below sight lines, as specified for adjacent surfaces.

3.3.27. Light Coves: Paint light coves white whether a light lens is installed or not.

3.3.28. Interior Columns: Finish interior columns same as walls of room unless otherwise indicated.

3.3.29. Existing Spaces:

3.3.29.1. Refinish existing surfaces of rooms or areas which have been damaged, altered or otherwise affected by Work. Also finish "new" Work occurring thereon unless otherwise specified. Use same procedure as for new Work but primer (or filler, stain and sealer in case of varnish finish) may be omitted. Prepare existing surfaces as specified in this Section. Ensure finish matches previous finish.

3.3.29.2. Paint or repaint rooms or areas where noted on the Room Finish Schedule and/or as indicated on the Drawings.

3.3.29.3. Repaint surfaces entirely between changes of plane.

3.3.29.4. Use finish coat of respective new surface paint system for minor repair of existing finishes. Use system primer where existing finishes are damaged down to bare surface.

3.3.29.5. Extend painting to a suitable boundary to avoid a “patched” effect. Sand, wire-brush, or scrape such existing finished surfaces to remove loose paint and to reduce gloss. Also, clean existing films of dirt, grease or wax. If metallic surfaces are rusted, remove loose scale to provide a firm surface. Patch and sand cracks and other imperfections.

3.3.29.6. Provide paint to interior existing spaces effected by alterations in accordance with following:

3.3.29.6.1. Paint walls to nearest inside and outside corners for full wall height.

3.3.29.6.2. Paint columns floor to ceiling.

3.3.29.6.3. Paint full ceilings to nearest wall or bulkhead.

3.3.29.6.4. Unless indicated otherwise match existing colour.

3.3.30. Mechanical and Electrical Services:

3.3.30.1. Unless otherwise specified or noted in the Contract Documents, paint “unfinished” conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and texture to match adjacent surfaces, in following areas:

3.3.30.1.1. where exposed-to-view in exterior and interior areas.

3.3.30.1.2. in interior high humidity interior areas.

3.3.30.1.3. in boiler room, mechanical and electrical rooms.

3.3.30.2. Read Divisions 21, 22, 23, 26, 27 and 28 for their requirements and further instruction on painting mechanical and electrical work and perform such work under supervision of respective mechanical and electrical Divisions.

3.3.30.3. Finish paint primed mechanical equipment: heaters, convectors, radiators, wall fin perimeter induction units, fan coil units and similar items. Ensure use of heat resistant paint on surfaces where operating surface temperature will exceed 65 deg C (150 deg F).

3.3.30.4. Prime and paint exposed, unfinished electrical raceways, fittings, outlet boxes, junction boxes, pull boxes and similar items.

3.3.30.5. Take steps to protect gauges, identification plates and similar items from being painted over or paint splattered.

3.3.30.6. Remove grilles, covers, access panels for mechanical and electrical systems from installed location and paint separately, if these items are not factory finished. Paint adjacent surfaces after removal and reinstall when surfaces are dry.

3.3.30.7. Paint Work to match surfaces they are seen against unless directed otherwise by the Consultant.

3.3.30.8. Paint interior surfaces of air ducts visible through grilles and louvres, with 1 coat of flat black metal paint to limit of sight line.

3.3.30.9. In unfinished areas leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

3.3.30.10. Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

3.3.30.11. Do not paint over nameplates.

3.3.30.12. Paint behind louvres grilles and diffusers for minimum of 460 mm (18") or beyond sight line, whichever is greater, to be painted with primer and 1 coat of matte black (non-reflecting) paint.

3.3.30.13. Paint each surface inside of light valances.

3.3.30.14. Paint disconnect switches for fire alarm system and exit light systems in colour as required by Authorities Having Jurisdiction.

3.3.30.15. Paint or band fire protection piping and sprinkler lines in accordance with mechanical requirements. Keep sprinkler heads free of paint.

3.3.30.16. Paint or band all natural gas piping in accordance with mechanical requirements

3.3.30.17. Back prime and paint face and edges of plywood service panels for telephone and electrical equipment before installation gray, semi-gloss. Leave equipment in original finish except for touch-up as required and paint conduits, mounting accessories and other unfinished items.

3.4. SITE QUALITY CONTROL

3.4.1. Site Tests and Inspections:

3.4.1.1. Provide and coordinate Site inspection service by manufacturer's representative in advance of Work commencing and during progress of Work to ensure correct use and application of each specified material. Manufacturer's representative to review and submit approval of surface preparation methods in Specifications or obtain specific recommendations for alternative methods. Report such conditions to the Consultant.

3.4.1.2. As Work progresses and upon completion of Work, submit written reports and manufacturers' confirmation that materials and application methods conform to manufacturers' requirements.

3.4.1.3. Inspect surfaces, preparation and paint applications.

3.4.2. Non-Conforming Work:

3.4.2.1. Replace damaged Work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction to the Consultant at no cost to the Owner. Touch up small affected areas, repaint large affected areas or areas without sufficient DFT of paint. Remove runs, sags of damaged paint by scraper or by sanding prior to application of paint. Following are considered nonconforming qualities:

3.4.2.1.1. Lack of Uniformity:

3.4.2.1.1.1. b rush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas and foreign materials in paint coatings.

3.4.2.1.1.2. evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.

3.4.2.1.1.3. damage due to touching before paint is sufficiently dry or any other contributory cause.

3.4.2.1.1.4. damage due to application on moist surfaces or caused by inadequate protection from weather.

3.4.2.1.1.5. damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).

3.4.2.1.2. Aesthetic Problems: If following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:

3.4.2.1.2.1. visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 1 m (39”).

3.4.2.1.2.2. visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 1 m (39”).

3.4.2.1.2.3. visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.

3.4.2.1.2.4. when final coat on any surface exhibits a lack of uniformity of colour, sheen, texture and hiding across full surface area.

3.4.3. Manufacturer Services: Arrange for manufacturer’s representative to visit Site at intervals during surface preparation and paint coating application to ensure proper specified surface preparation is being performed, specified Product are being used, appropriate number of coats are being applied and specified finishing procedures are being carried out.

3.5. CLEANING

3.5.1. Keep waste rags in covered metal drums containing water and remove from building at end of each Day. Remove other combustible rubbish materials and empty paint cans each Day from Site and safely dispose of same in accordance with requirements of Authorities Having Jurisdiction.

3.5.2. Clean equipment and dispose of wash water/solvents as well as other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers/strippers in accordance with safety requirements of authorities having jurisdiction.

3.5.3. Clean containers used for storage, mixing and application of materials free of foreign materials and residue.

3.5.4. Keep Work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.

3.5.5. Clean adjacent surfaces which have been painted, soiled or otherwise marred. Remove spilled, splashed, splattered or sprayed paint as Work progresses using means and materials that are not detrimental to affected surfaces.

3.5.6. Remove masking and other protection provided under this Section.

3.5.7. Remove temporary protective wrappings provided by others for protection of Work after completion of painting operations.

3.5.8. Painting work will not be considered complete until spatters, drippings, smears and overspray have been cleaned and removed to satisfaction of the Consultant.

3.5.9. Make Good any damage to structure building surfaces or furnishings resulting from painting operations at no cost to the Owner.

3.5.10. Waste Management:

3.5.10.1. Disposal of Paint Waste:

3.5.10.1.1. Be responsible for removal and disposal of material and waste generated by the Work of this Section.

3.5.10.1.2. Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.) are hazardous Products and are subject to regulations for disposal. Obtain information on these controls from applicable Authorities Having Jurisdiction.

3.5.10.1.3. Separate and recycle waste materials. Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility. Treat materials that cannot be reused as hazardous waste and dispose of in an appropriate manner.

3.5.10.1.4. Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

3.5.10.1.5. To reduce amount of contaminants entering waterways, sanitary/storm drain systems or into ground adhere to following procedures:

3.5.10.1.5.1. Retain cleaning water for water-based materials to allow sediments to be filtered out. In no case clean equipment using free draining water.

3.5.10.1.5.2. Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

3.5.10.1.5.3. Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

3.5.10.1.5.4. Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.

3.5.10.1.5.5. Dry empty paint cans prior to disposal or recycling (where available).

3.5.10.1.5.6. Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

3.5.10.2. Set aside and protect surplus and uncontaminated finish materials not required by the Owner and deliver or arrange collection for verifiable re-use or re-manufacturing.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL INSTRUCTIONS

1.1.1. Read and conform to the Contract Documents including Division 1 requirements and documents referred to herein.

1.2. SUMMARY

1.2.1. Section Includes: Provide miscellaneous specialties including but not limited to following:

1.2.1.1. Waste paper baskets.

1.3. SUBMITTALS

1.3.1. Samples: Submit samples in accordance with Section 01 30 00. If requested by Consultant submit samples of Products.

1.4. CLOSEOUT SUBMITTALS

1.4.1. Operational and Maintenance Data: Submit maintenance instructions in accordance with Section 01 70 00.

PART 2 - PRODUCTS

2.1. ASSEMBLY

2.1.1. Description:

2.1.1.1. Regulatory Requirements: Provide a Pre-Start Health and Safety Review in accordance with the *Occupational Health and Safety Act,* R.S.O. 1990, c. O.1 Regulation 851, Industrial Establishments, as amended. Refer to Section 01 40 00 for further requirements.

2.2. MANUFACTURED UNITS

2.2.1. Provide waste paper baskets and bins by Swish Maintenance Products Ltd. Systems or Equivalent. Refer to Drawings.

2.2.1.1. Rubbermaid 23GAL WASTE BIN AND LID #3540-60-B & #SP42189 or Equivalent

2.2.1.2. Rubbermaid 23GAL RECYCLING BIN AND LID #3540-BLU & #SP42189 or Equivalent

2.2.1.3. Rubbermaid 23GAL ORGANICS BIN AND LID #3540-GRN & SP42189 or Equivalent

2.2.1.4. Busch Systems Battery Bin #BATBIN-24B0 or Equivalent

2.2.1.5. Swish Blue Recycling Bin #2956-BLU or Equivalent

2.2.1.6. Busch Systems hanging waste caddy with lid #BC1500-23 or Equivalent

2.2.1.7. Swish soft waste basket #2956-BK or Equivalent

2.2.1.8. Swish soft recycling basket #2956-BLU or Equivalent2.2.1.9. Swish soft recycling receptacle #3450-BLU with Lid #2703 or Equivalent

2.2.2. Frost paper towel dispenser (wall mounted) #5050 or Equivalent

2.2.3. Swish soap dispenser (wall mounted) #9330 or Equivalent

2.2.3.1. Fabrication:

2.2.3.1.1. Do not expose trademarks or labels on finished surfaces

2.2.4. Provide appliances by Whirlpool and Panasonic or Equivalent as follows:

2.2.4.1. 16.6-cu ft. Freezerless Refrigerator. Colour shall be white. Manufacturer to be Whirlpool or Equivalent.

2.2.4.2. Panasonic 1.6 cu. ft. Countertop Microwave Oven with Inverter Technology – White – #NN-SN736W or Equivalent

PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Verification of Conditions: Verify actual Site dimensions and location of adjacent materials prior to commencing Work. Notify Consultant in writing of any conditions which would be detrimental to the installation.

3.1.2. Evaluation and Assessment: Commencement of Work implies acceptance of previously completed Work.

3.2. PROTECTION

3.2.1. Cover finished surfaces and protect exposed corners and areas vulnerable to damage by persons or by movement of materials, tools or equipment.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 This Section covers items common to all sections of Divisions 21, 22 and 23 and 25 is intended only to supplement the requirements of Division 1 and documents referred to therein.

1.2 SCOPE

.1 Provide all labour, equipment, materials and services necessary for complete and operating systems as indicated in the Contract Documents.

.2 Allocate the scope of work of each supplier and trade as required to achieve complete and operating systems and to complete the work.

.3 If differences occur within the Contract Documents, provide the most stringent requirement as determined by the Region .

1.3 ABBREVIATIONS AND DEFINITIONS

.1 The following abbreviations apply to this Division. Any abbreviations not listed will be as defined by ASHRAE.

AABC	-	Associated Air Balance Council
ABMA	-	American Boiler Manufacturers Association
AC	-	Alternating Current
AGA	-	American Gas Association
AMCA	-	Air Moving and Conditioning Association
ANSI	-	American National Standards Institute
AI	-	Analogue Input
AO	-	Analogue Output
ARI	-	Air-Conditioning and Refrigeration Institute
ASHRAE	-	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society for Testing and Materials
AWWA	-	American Water Works Association
BAS	-	Building Automation System
bhp	-	Boiler Horsepower or Brake Horsepower
BTU	-	British Therma Unit
BTU/hr	-	British Thermal Units per Hour
BWG	-	British Wire Gauge
CGA	-	Canadian Gas Association
cfm	-	Cubic Feet Per Minute
CGSB	-	Canadian Government Specification Board
ci	-	Cast Iron
C	-	Celsius
CSA	-	Canadian Standards Association
dB	-	Decibel
DB	-	Dry Bulb
DI	-	Digital Input
DO	-	Digital Output
°C	-	Degrees Celsius

°F	-	Degrees Fahrenheit
EEMAC	-	Electrical and Electronic Manufacturers' Association of Canada
EMT	-	Electrical metallic tubing
FM	-	Factory Mutual
fpm	-	Feet Per Minute
ft or '	-	Foot or Feet
hp	-	Motor Horsepower
IAO	-	Insurance Advisory Organization of Canada
gpm	-	Gallons Per Minute (Imperial)
HVAC	-	Heating Ventilating and Air Conditioning
in or "	-	Inch or Inches
kg	-	Kilogram
kOhm	-	Kilo Ohm
kPa	-	Kilopascals
kW	-	KiloWatt
lbs/hr	-	Pounds per Hour
l	-	Litre
LED	-	Light Emitting Diode
l/s	-	Litres per Second
MBH	-	1000 British Thermal Units Per Hour
mm	-	Millimetre
m	-	Metre
m/s	-	Metres Per Second
ml	-	Millilitre
NBC	-	National Building Code
NBS	-	National Bureau of Standards
NC	-	Noise Criterion as Defined by ASHRAE
NEMA	-	National Electrical Manufacturer's Association
NFPA	-	National Fire Protection Association
NPS	-	Nominal Pipe Size
NPT	-	National Pipe Thread
NPSH	-	Net Positive Suction Head
OBC	-	Ontario Building Code
OS & Y	-	Outside Screw and Yoke
Pa	-	Pascal
pH	-	Hydrogen Ion Concentration
oz	-	Ounce or Ounces
ppm	-	Parts Per Million
psig	-	Pounds Per Square Inch Gauge
RC	-	Room Criterion as Defined by ASHRAE
rpm	-	Revolutions Per Minute
SMACNA	-	Sheet Metal and Air Conditioning Contractors National Association
SP in WG	-	Static Pressure, Inches Water Gauge
s.qm	-	Square metre
ss	-	Stainless Steel
TEMA	-	Tubular Exchanger Manufacturers Association
UL	-	Underwriters' Laboratories
ULC	-	Underwriters’ Laboratories Canada
USgpm	-	United States Gallons Per Minute
VDC	-	Volts Direct Current
W	-	Watt
WB	-	Wet Bulb
WG	-	Water Gauge

1.4 REGULATIONS, CODES AND FEES

.1 All work shall be done to the requirements of the Authorities Having Jurisdiction, including but not limited to plans examiner, building inspector, utility representatives. These are minimum requirements only. In addition, the Contractor shall comply with the requirements contained in the Contract Documents

.2 Apply for and provide all permits, fees, connections, inspections, licenses, certificates or charges necessary to complete the work of this Division.

.3 Report to the Consultant any changes requested by the Authorities Having Jurisdiction. Carry out any changes that do not require extra materials without cost to the Owner.

.4 Provide any additional documentation requested by the Authorities Having Jurisdiction.

1.5 EXAMINATION OF SITE AND CONDITIONS

.1 Examine the Site, local conditions and Contract Documents prior to submission of Tenders. The submission of a Tender confirms acceptance of the Contract Documents and Site and local conditions.

1.6 DRAWINGS

.1 The Drawings of this Division show the general intent of the Work, not the details of installation. The Drawings shall be used by the Contractor in conjunction with all other Division Drawings to establish the requirements of routing and installation.

.2 Obtain all dimensions from field measurement, or from dimensioned drawings if field measurement is not possible. Confirm all dimensions by field measurement prior to installation.

.3 Provide all changes necessary to eliminate interference.

.4 Reroute or relocate any system or equipment prior to its installation without cost provided that the change does not increase the total quantity of material.

1.7 INSTALLATION DRAWINGS

.1 Provide sleeving drawings showing all openings in the structure with all required dimensions. Provide all changes necessitated by the submission of incorrect or late information, at the Contractor's own expense.

.2 Provide installation drawings of all work, with dimensions, drawn to scale and co-ordinate with all Subcontractors and Divisions. These drawings shall show the actual equipment installed. The scale of open areas shall be 1/8" = 1'-0", or 1:100; corridors, mechanical rooms and congested areas shall be a minimum of 1/4" = 1'-0" or 1:50. Show all requirements for area access, clearances and connections by other Subcontractors.

.3 Provide structural loads with all details necessary for the installation of inserts. Co-ordinate and distribute the loads to match structural capacities. Provide drawings of all concrete construction items, including pads, curbs, sills, basins, anchors, inserts, etc.

.4 Allow provision for installation of future products.

.5 Submit all installation and sleeving drawings prior to commencement of the Work. Submit copies of Drawings to the Subcontractors of all Divisions.

1.8 SHOP DRAWINGS

.1 Refer to Section 01 30 00 Administrative Requirements of the Specifications..

.2 As a minimum, submit six (6) copies of Shop Drawings plus one (1) reproducible copy.

.3 Shop Drawings shall indicate clearly the materials and/or equipment actually being supplied. Each Shop Drawing shall give the identifying number of the item for which it was prepared.

.4 Each Shop Drawing for non-catalogue items shall be prepared specifically for this project. Any optional items not to be included for the project shall not appear on the drawings. Shop Drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.

.5 Shop Drawings shall include the following data where applicable:

.1 Manufacturer's name and model number.

.2 Shipping and operating weights.

.3 Physical arrangement showing all dimensions and including arrangement, size and location of all piping and duct connections.

.4 Clearances required for servicing.

.5 Materials used in manufacture.

.6 Finish.

.7 Performance characteristics.

.8 Electrical characteristics including full load current, motor sizes and motor start time.

.9 Wiring schematics indicating connections to remote devices.

.10 Approval agencies.

.11 Manufacturer's recommended installation instructions.

.12 Each Shop Drawing or catalogue sheet shall be stamped and signed by the Contractor and all applicable Subcontractors to indicate that the drawings have been checked for conformance with all requirements of the Contract Documents, that the equipment concerned has been co-ordinated with other equipment to which it is attached and/or connected, and that all dimensions have been verified to ensure the proper installation of the equipment within the available space and without interference with the work of other Subcontractors. Ensure that electrical and all other co-ordination is complete before submission of Shop Drawings.

.6 Installation or manufacture of any Product shall not start until after review of Shop Drawings.

.7 When requested, Shop Drawings shall be supplemented by data explaining the theory of operation, which is to be added to the maintenance and operating manual.

.8 Provide a schedule of Shop Drawings as per the Region’s Notice to Commence Work indicating submission and required dates.

.9 Provide samples of items as requested by the Consultant.

1.9 RECORD DRAWINGS

.1 Obtain and pay for one (1) set of white prints for mark up as the job progresses for final submission to the Owner indicating all as-built conditions and information. Mark up shall be done on a continuing basis and will be checked with each progress payment.

.2 The as-built/ record drawings shall indicate all access requirements, inverts, dimensional locations and elevations of underground or in structure services, all clearance requirements, all locations of future connections, all change order and addendum items, all operating life safety devices, and all hidden items requiring service.

.3 The final submission of as-built/ record drawings shall include two (2) sets of white prints and two (2) copies of compact disk (CD) in AutoCad 2019 format.

1.10 PRODUCTS

.1 Products shall be new and free from all defects.

.2 Products not specifically specified shall be of a quality consistent with the remainder of the Specifications.

.3 All products shall bear the seal of approving agencies as required by the Authorities Having Jurisdiction.

.4 All products of one type shall be by the same manufacturer.

1.11 ALTERNATIVES AND SUBSTITUTIONS

.1 No substitutions shall be made without the prior written approval of the Consultant.

.2 Any alternatives suggested shall be accompanied by all data required to evaluate the alternative. Alternatives shall be accepted only at the sole discretion of the Consultant and the Owner.

.3 The Contractor shall be responsible for the performance, extra cost and/or liability for, all substitutions and alternatives.

1.12 CONSTRUCTION USE OF EQUIPMENT

.1 Permanent HVAC equipment shall not be used to dry out the building materials following construction.

.2 Equipment shall not be used for construction purposes without written permission from the Owner.

.3 If equipment is used for construction purposes it shall be returned to as-new condition prior to hand over.

.4 The Contractor shall accept all costs and liabilities of the construction use of any equipment.

1.13 CONNECTION OF EQUIPMENT

.1 Provide all connections required by equipment supplied by the Owner or under other Divisions.

.2 Provide all necessary accessories to make connections, including valves, caps, unions, flexible connectors, etc.

1.14 CERTIFICATION

.1 Where specified in the mechanical Contract Documents, provide the services of a technical representative of the manufacturer to inspect the equipment, including its installation and operation. Provide a letter from the manufacturer certifying that this has been carried out successfully, and that all aspects of the installation are acceptable.

.2 Manufacturers technical representatives shall perform start-up of all major equipment, and issue start-up report, where specified in the Contract Documents.

1.15 MANUALS

.1 Provide three (3) bound sets of Operating and Maintenance Manuals.

.2 Manuals shall be to the approval of the Consultant. Submit format of manual, including index, for approval prior to assembly.

.3 Include the following in the Manuals for each item of equipment:

.1 Final revised Shop Drawings.

.2 Operating instructions.

.3 Maintenance instructions and schedule.

.4 List of recommended spare parts.

.4 Include copies of all valve charts indicating number, size, type, service, location and model number of each valve.

.5 Include a section for controls including:

.1 Control schematics.

.2 Sequences of Operation.

.3 All setpoints.

.4 Catalogue data sheet for all control components.

1.16 SPARE PARTS AND TOOLS

.1 Provide all specialized tools required for routine equipment and system operation and maintenance.

.2 Provide one spare set of belts for each belt driven fan, including those included in packaged air conditioning equipment.

.3 Provide one spare set of filters for each air conditioning unit.

1.17 WARRANTY

.1 Provide a written warranty for all materials, equipment and labour for a twenty-four month period, such warranty to take effect in accordance with Article A-6 of the Articles of Agreement.

.2 Provide extended warranties where specified in individual Division 21, 22, 23 and 25 sections.

1.18 PREMIUM TIME

.1 Any costs for premium time to complete the work on schedule and to maintain all mechanical systems in operation shall be included in the Contract Price.

1.19 VALUATION OF CHANGES

.1 Provide a complete itemized breakdown of material and labour for each change at net cost.

1.20 CO-ORDINATION

.1 Co-ordinate the Work of this Division with that of all other Divisions.

.2 Co-ordinate the Work of this Division with all other Divisions for locations of openings, spaces, services, sleeves, supports, connections, etc.

1.21 WORKMANSHIP

.1 Conform to the standards of excellence and good practice for each respective trade. All applicable regulations and codes represent the minimum acceptable standards. Applicable codes include Ontario Building Code (OBC), NFPA codes, Occupational Safety and Health Administration (OSHA) guidelines, Technical Standards and Safety Authority (TSSA) regulations, American Society of Heating, Ventilating and Air Conditioning Engineers (ASHRAE) guides.

1.22 FIELD REVIEW

.1 The Consultant and Owner shall have access to the Site at all times for review of the Work.

.2 Correct any deficiencies as they are reported during the performance of the Work.

1.23 PIPING TESTING, CLEANING AND FLUSHING OF SYSTEMS

.1 All work shall be subject to inspection by the Town of Newmarket's Building Department Inspectors and/or the Consultant.

.2 Provide all labour, materials, instruments, etc., necessary for all required tests.

.3 Isolate all equipment which has an insufficient rating compared to the test pressure prior to testing of any piping.

.4 Repair all leaks to the approval of the inspection Authority and/or the Consultant. All leaks shall be repaired by remaking the joint.

1.24 PROTECTION

.1 Protect all finished and unfinished Work of this and other Divisions from damage.

.2 All HVAC ductwork and equipment, including existing equipment, shall

be protected from exposure to moisture and from collecting dust, debris, odours and other contaminants while demolition and construction activities are ongoing.

.3 Keep equipment dry and clean at all times and cover openings in equipment and materials.

.4 Make good any damage to walls, floors, ceilings, woodwork, brickwork, finishes, etc., however caused.

.5 Make good to as new quality, or replace, any damaged equipment, as directed by the Consultant.

.6 All ductwork and piping systems shall be fully capped during construction to prevent the entry of debris into the mechanical duct and piping systems. Open ended piping and ductwork shall be covered and capped at all times during construction. Ductwork shall be covered with a self adhesive product, Dyn-O-wrap or Equivalent.

1.25 PAINTING

.1 Painting of mechanical ductwork, piping etc. shall be provided in accordance with the requirements of Section 09 91 00 Painting.

.2 All mechanical equipment shall be provided with factory applied paint finish.

1.26 CUTTING AND PATCHING

.1 Do all cutting and patching for the Work of this Division. Before proceeding obtain Consultant's approval.

.2 Where necessary to completely penetrate existing floors, walls, ceiling, roof or structural members, provide sleeve and follow Consultant's instructions.

.3 Have all patching and repairing done by the respective trades whose work is affected at the Contractor’s own expense.

1.27 ACCESS PANELS AND DOORS

.1 Provide all access panels and doors required for access to all equipment provided under Divisions 21, 22 and 23.

.2 Minimum sizes shall be 150 mm x 150 mm (6" x 6") for hand access, and 600 mm x 450 mm (24" x 18") for person access.

.3 Provide access doors with fire rating equal to the surfaces in which installed.

.4 Provide panels in glazed tile walls of 2.5 mm (12 gauge) 304 stainless steel #4 finish, with recessed frames secured with counter-sunk flush-head screws.

.5 Provide panels in plaster surfaces with recessed door with welded metal lath ready to accept plaster and with a plaster grommet for door key access.

.6 Provide other access doors of 2.5 mm (12 gauge), flush with concealed hinges, anchor strap and lock, all factory prime coated.

1.32 ELECTRIC MOTORS

.1 All motors up to 0.4 kW (1/2 hp) shall be 120 V single phase and all motors 0.6 kW (3/4 hp) and above shall be 3-phase as specified in the EQUIPMENT SCHEDULES on the mechanical

Drawings.

PART 3 - EXECUTION

3.1 PAINTING

.1 Painting of mechanical ductwork, piping etc. shall be in accordance with the requirements of Section 09 91 00 Painting.

3.2 CUTTING AND PATCHING

.1 Provide cutting and patching in accordance to the section 07 84 00 of the Specifications.

3.3 ACCESS PANELS AND DOORS

.1 Provide access panels and doors wherever required for access to Products or for testing and balancing.

.2 Indicate all access panels and doors on construction drawings. Do not install any access panels or doors without prior approval of Consultant. Indicate location of all access panels and doors on Record Drawings.

.3 Provide all panels, doors and frames to the Subcontractors of the appropriate Divisions for installation.

.4 Supply details of doors prior to installation.

.5 Mark all lay-in tiles that are used for access in a manner approved by the Consultant.

END OF SECTION

PART 1 – GENERAL

1.1 General

.1 The purpose of this section is to specify responsibilities in the commissioning process for the work of Division 21.

.2 The systems to be commissioned are listed in Section 01 91 00, subsection 1.9. The abbreviations and definitions used in Section 01 91 00 apply to this Section 21 08 00 – Fire Suppression System Commissioning.

.3 Commissioning shall take into account the requirements under Division 21 to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 01 91 00. For the purposes of completing work under Division 21, the Contractor shall be familiar with all parts of Section 01 91 00 and the commissioning plan issued by the CA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.2 Responsibilities

.1 Fire Suppression Subcontractor: The responsibilities of the Contractor and its Fire Suppression Subcontractor, during construction and acceptance phases in addition to those listed above are (all references apply to commissioned equipment only) are as follows:

.1 Documentation of all procedures performed shall be provided and forwarded to the Consultant. Written documentation must contain recorded test values of all tests performed per the individual product specification.

.2 The start-up service company shall be present during energization of the plumbing equipment. Jobsite and equipment access must be provided by the Fire Suppression Subcontractor.

.3 Supply a power source, specified by the start-up service company, for on-site test equipment.

.4 Attend all factory witness testing required within the respective specification sections. The Contractor shall include all related costs in the total Contract Price submitted with its bid.

.5 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.6 The Contractor shall include the cost of commissioning in the total Contract Price, submitted with its bid..

.7 The Contractor shall ensure it complies with the requirements of GC -10 Subcontractors and ensures that the Fire Suppression Subcontractor complies with the Contract requirements for submittal data, O&M data and training.

.8 Attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.

.9 Provide normal cut sheets and Shop Drawing submittals to the CA of commissioned equipment. Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of pre-functional and functional testing procedures.

.1 Include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Agent.

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

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

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

.12 Provide assistance to the CA in preparation of the specific functional performance test procedures specified in Division 21. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

.13 Develop a full start-up and checkout plan using manufacturer's start-up procedures and the pre-functional test sheets from the CA. Submit manufacturer's detailed start-up procedures and the full start-up plan and procedures and other requested equipment documentation to CA for review.

.14 During the startup and checkout process, execute and document the mechanical-related portions of the pre-functional test sheets provided by the CA for all commissioned equipment.

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

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

.17 Perform functional performance testing under the direction of the CA for specified equipment in Section 01 91 00, subsection1.9. Assist the CA in interpreting the monitoring data, as necessary.

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

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

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

.21 Provide training of the Owner's operating personnel as specified in the Contract Documents.

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

.23 Execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.

.24 Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

.25 Assist and cooperate with the Mechanical and TAB Subcontractor and CA by:

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

.2 List and clearly identify on the as-built drawings the locations of equipment.

.3 Prepare a preliminary schedule for Division 21 equipment start-up, as well as TAB start and completion for use by the CA. Update the schedule as appropriate.

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

PART 2- PRODUCTS

.1 NOT USED

PART 3- EXECUTION

3.1 Submittals

.1 Provide submittal documentation relative to commissioning under Division 21 to the CA as requested by the CA. Refer to Section 01 91 00 Part 3.3 for additional Section 21 requirements.

3.2 Start-up of Equipment

.1 Follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in 01 91 00. Ensure the start-up responsibility under Division 21 is met and complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning agent or Owner.

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

.3 Prior to the start up of equipment under Division 21 the Contractor shall arrange to have the manufacturer of all major equipment inspect the installation to ensure their equipment has been installed in accordance with their recommendations.

.4 The manufacturer shall submit a written report of their findings.

.5 Upon confirmation that the equipment has been installed in accordance with the Manufacturers Recommendations the equipment may be started.

.6 All equipment shall be started by the manufacturer’s representative.

3.3 Pre-Functional Test Sheets

.1 Pre-functional test sheets contain items to be performed under Division 21. On each checklist, a column is provided that is to be completed by the Contractor assigning responsibility for that line item to a trade. Those executing the test sheets are only responsible to perform items that apply to the specific application at hand. These test sheets do not take the place of the manufacturer's recommended checkout and start-up procedures or report. Some checklist procedures may be redundant in relation to checkout procedures that will be documented on typical factory field checkout sheets. Double documenting may be required in those cases.

.2 Refer to Section 01 91 00 for additional requirements regarding pre-functional test sheets, startup and initial checkout.

3.4 Operations and Maintenance Manuals

.1 Compile and prepare documentation for all equipment and systems covered in Division 21 and deliver to the GC for inclusion in the O&M manuals

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

3.5 Training of Owner Personnel

.1 The GC shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed. Refer to Section 01 91 00 for additional details.

.2 The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment. Refer to Section 01 91 00 for additional details.

.3 Fire Suppression Contractor. The Contractor shall ensure the Fire Suppression Subcontractor meets the following training responsibilities:

.1 Provide the CA with a training plan two weeks before the planned training according to the outline described in Section 01 91 00, Part 3.8.

.2 Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of commissioned fire suppression equipment

.3 Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including start-up, shutdown, fire/smoke alarm, power failure, etc.

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

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

.6 The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.

.7 Training shall include:

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

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

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

.4 Discussion of warranties and guarantees.

.5 Common troubleshooting problems and solutions.

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

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

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

.9 Ensure the Fire Suppression Subcontractor fully explains and demonstrates the operation, function and overrides of any local packaged controls, not controlled by the central control system.

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

3.6 Deferred Testing

.1 Refer to Section 01 91 00, Part 3.9 for requirements of deferred testing.

3.7 WRITTEN WORK PRODUCTS

.1 Written work products under Division 21 shall consist of the start-up and initial checkout plan as described in Section 01 91 00, as well as completed start-up, initial checkout and pre-functional test sheets.

END OF SECTION

PART 1 – GENERAL

1.1 General

.1 The purpose of this section is to specify Division 22 responsibilities in the commissioning process.

.2 The systems to be commissioned are listed in Section 01 91 00.1.9.

.3 Commissioning requires the participation of Division 22 to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 01 91 00. Division 22 shall be familiar with all parts of Section 01 91 00 and the commissioning plan issued by the CA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.2 Responsibilities

.1 Plumbing Contractor: The responsibilities of the Plumbing Contractor, during construction and acceptance phases in addition to those listed above are (all references apply to commissioned equipment only):

.1 Documentation of all procedures performed shall be provided and forwarded to the Consultant. Written documentation must contain recorded test values of all tests performed per the individual product specification.

.2 The start-up service company shall be present during energization of the plumbing equipment. Site and equipment access must be provided by the plumbing Subcontractor.

.3 The Contractor shall supply a power source, specified by the start-up service company, for on-Site test equipment.

.4 The plumbing Subcontractor is to attend all factory witness testing required within the respective Specification sections. The Contractor is responsible to cover all their costs and include them in their bid.

.5 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.6 Include the cost of commissioning in the Contract Price, if not yet included.

.7 In each purchase order or subcontract written, include requirements for submittal data, Operating and Maintenance (O&M) data and training.

.8 Attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.

.9 Contractor shall provide normal cut sheets and Shop Drawing submittals to the CA of commissioned equipment. Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of pre-functional and functional testing procedures.

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

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

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

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

.12 Provide assistance to the CA in preparation of the specific functional performance test procedures specified in Section 22. Subcontractors shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

.13 Develop a full start-up and checkout plan using manufacturer's start-up procedures and the pre-functional test sheets from the CA. Submit manufacturer's detailed start-up procedures and the full start-up plan and procedures and other requested equipment documentation to CA for review.

.14 During the startup and checkout process, execute and document the mechanical-related portions of the pre-functional test sheets provided by the CA for all commissioned equipment.

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

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

.17 Perform functional performance testing under the direction of the CA for specified equipment in Section 01 91 00, subsection1.9. Assist the CA in interpreting the monitoring data, as necessary.

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

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

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

.21 Provide training of the Owner's operating personnel as specified in Section 25 00 00.

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

.23 Execute seasonal or deferred functional performance testing, witnessed by the CA, according to the Specifications.

.24 Correct deficiencies and make necessary adjustments to O&M manuals and as-built Drawings for applicable issues identified in any seasonal testing.

.25 Assist and cooperate with the mechanical and Testing, Adjusting Balancing (TAB) Subcontractor and CA by:

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

.2 Providing temperature and pressure taps according to the Contract Documents for TAB and commissioning testing.

.26 Install a Pressure Transducer (P/T) plug at each water sensor which is an input point to the control system.

.27 List and clearly identify on the as-built Drawings the locations of applicable sensors and meters

.28 Prepare a preliminary schedule, in conjunction with Division 25 Subcontractors for Division 22 pipe system testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the CA. Update the schedule as appropriate.

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

PART 2 - PRODUCTS

.1 NOT USED

PART 3 - EXECUTION

3.1 Submittals

.1 The Contractor shall ensure that Section 22 Subcontractors provide submittal documentation relative to commissioning to the CA as requested by the CA. Refer to Section 01 91 00 Part 3.3 for additional Section 22 requirements.

3.2 Start-up of Equipment

.1 The plumbing Subcontractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in 01 91 00. Division 22 has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning agent or Owner.

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

.3 Prior to the start up of equipment the Division 22 Contractor shall arrange to have the manufacturer of all major equipment inspect the installation to ensure their equipment has been installed in accordance with their recommendations.

.4 The Supplier shall submit a written report of their findings.

.5 Upon confirmation that the equipment has been installed in accordance with the manufacturer's recommendations the equipment may be started.

.6 All equipment shall be started by the manufacturer's representative.

3.3 Pre-Functional Test Sheets

.1 Pre-functional test sheets contain items for Section 22 Subcontractors to perform. On each checklist, a column is provided that is to be completed by the Contractor assigning responsibility for that line item to a trade. Those executing the test sheets are only responsible to perform items that apply to the specific application at hand. These test sheets do not take the place of the manufacturer's recommended checkout and start-up procedures or report. Some checklist procedures may be redundant in relation to checkout procedures that will be documented on typical factory field checkout sheets. Double documenting may be required in those cases.

.2 Refer to Section 01 91 00 for additional requirements regarding pre-functional test sheets, startup and initial checkout. Items that do not apply should be noted along with the reasons on the form. If this form is not used for documenting, one of similar rigor and clarity shall be used pending approval from the CA. Contractor's assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their Subcontractors are completed and checked off. "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = Architect/Engineer, All = all Contractors, CA = Commissioning Agent, CC = Controls Contractor, EC = Electrical Contractor, PM/GC = General Contractor, MC = Mechanical Contractor, SC = Sheet Metal Contractor, TAB = Test and Balance Contractor.

3.4 Operations and Maintenance Manuals

.1 The Contractor shall ensure that Section 22 Subcontractors compile and prepare documentation for all equipment and systems covered in Section 22 and deliver to the Contractor for inclusion in the O&M manuals.

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

3.5 Training of Owner Personnel

.1 The Contractor shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed. Refer to Section 01 91 00 for additional details.

.2 The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment. Refer to Section 01 91 00 for additional details.

.3 Mechanical Contractor. The mechanical contractor shall have the following training responsibilities:

.1 Provide the CA with a training plan two weeks before the planned training according to the outline described in Section 01 91 00, Part 3.8.

.2 Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, pumps, boilers, furnaces, chillers, heat rejection equipment, air conditioning units, air handling units, fans, terminal units, controls and water treatment systems, etc.

.3 Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including start-up, shutdown, fire/smoke alarm, power failure, etc.

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

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

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

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

.8 Training shall include:

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

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

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

.4 Discussion of warranties and guarantees.

.5 Common troubleshooting problems and solutions.

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

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

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

.10 Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.

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

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

.13 Training shall occur after functional testing is complete, unless approved otherwise by the Consultant.

3.6 Deferred Testing

.1 Refer to Section 01 91 00, Part 3.9 for requirements of deferred testing.

3.7 WRITTEN WORK PRODUCTS

.1 The Contractor shall ensure that written work products of Section 22 Subcontractors consist of the start-up and initial checkout plan as described in Section 01 91 00, as well as completed start-up, initial checkout and pre-functional test sheets.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide complete plumbing and drainage systems, including all necessary labour, services, Products, materials and equipment as shown on the Drawings and listed in the schedules as specified herein. Products, materials and equipment shall include, but not necessarily be limited to, the following:

.1 Piping and fittings.

.2 Valves.

1.2 REFERENCE STANDARDS

.1 Provide all Work in accordance with the latest edition of the Ontario Plumbing Code and the requirements of all local Authorities Having Jurisdiction, including but not limited to plans examiner, building inspector, etc., and all applicable by-laws.

1.3 SUBMITTALS

.1 Submit Shop Drawings for each type of valve in accordance with Section 21 05 01.

.2 Submit Shop Drawings for grooved mechanical couplings and fittings in accordance with Section 21 05 01.

.3 Provide valve charts for inclusion in Operating and Maintenance Manuals in accordance with Section 21 05 01.

PART 2 - PRODUCTS

2.1 PLUMBING PIPING AND FITTINGS

.1 Provide pipe and fittings of good quality devoid of any defects and compatible with required system working pressure.

1 Domestic Water Piping

1 Above Ground - 100 mm (4") and smaller.

1 Type `L' hard copper pipe with wrought copper fittings and silver solder joints.

2 Sanitary Drain and Vent Piping.

1 Above Ground - 65 mm (2-1/2") and smaller.

1 Drain, Waste, Vent (“DWV”) copper with drainage fittings and 60/40 lead/tin solder joints.

2 Plastic drain, waste and vent piping is acceptable for use above grade provided it meets the minimum requirements for flame spread (25) and smoke developed (50) classifications as required by the Ontario Building Code (i.e. IPEX XFR or Equivalent).

2 Above Ground - 75 mm (3") and larger.

1 CSA class 4000 cast iron soil piping and drainage fittings.

2 Plastic drain, waste and vent piping is acceptable for use above grade provided it meets the minimum requirements for flame spread (25) and smoke developed (50) classifications as required by the Ontario Building Code (i.e. IPEX XFR or Equivalent).

2.2 VALVES

.1 Provide valves that are compatible with the piping and service required.

.2 Valves of each type shall be the product of one manufacturer.

2.3 WATER HAMMER ARRESTORS (SHOCK STOPS)

.1 Provide pre-charged hard drawn copper shock absorber with brass piston, Ethylene Propylene Diene Monomer (“EPDM”) O-ring seals and make IPS (Iron Pipe Size) connection.

.2 Suitable for pressures up to 150 psi, and temperatures to 180 F.

.3 Unit sizing as per manufacturers instructions. Confirm following sizing table with manufacturer, use manufacturers sizing guidelines.

FIXTURE UNITS	ARRESTOR SIZING
1-11	CONNECTION: ½”, HEIGHT: 5” DIAMETER: 1-7/16”
12-32	CONNECTION: ¾”, HEIGHT: 7” DIAMETER: 1-7/16”
33-60	CONNECTION: 1”, HEIGHT: , 7-3/8” DIAMETER: 2-3/16”
61-113	CONNECTION: 1-1/4”, HEIGHT:10-13/16” DIAMETER: 2-116”
114-154	CONNECTION: 1-1/2”, HEIGHT: 1-1/2” DIAMETER: 3-5/16”
155-330	CONNECTION: 2”, HEIGHT: 14-7/8” DIAMETER: 3-5/16”

2.4 PLUMBING VALVE SCHEDULE

PLUMBING VALVE SCHEDULE				
SYSTEM	PIPING	TYPE	SYSTEMS 50 MM (2") AND SMALLER	SYSTEMS 65 MM (2-1/2") AND LARGER
Domestic	Copper	Gate	Bronze, soldered, solid wedge disc, NRS, 200 psi CWP. (1324) Kitz #64	Iron body, flanged, solid wedge disc, O.S.&Y. bronze trim, RS 200 psi CWP. (465-1/2) Kitz#72 Toyo #421A
Domestic	Copper	Globe	Bronze, soldered, renewable teflon disc, 200 psi CWP. (1310) Kitz#10 Toyo #222	Iron body, flanged O.S.&Y., bronze trim, 200 psi CWP. (351) Kitz #76 Toyo#400A
Domestic	Copper	Ball (*)	Kitz#69AMLL Toyo#5049S MAS B3ZSS * Note Lock and Lever	2-1/2" and 3" same as 2" and smaller but 400 psi CWP.
Domestic	Copper	Butterfly (Lug Wafer Type)	Note: Butterfly valves shall be lugged type, cast Iron or Ductile iron body, Aluminum bronze disc, EPDM liner, stainless steel stem. Valves shall have bubble tight shutoff to 200psi when downstream flange is removed (Full dead-end service valves. 150mm (6") smaller shall have lever operator. Valves 200mm (8") & Larger shall have manual gear operator.	Iron body, flanged, anti-friction coated ductile iron disc, 416 stainless steel stem, EPDM seat, 150 psi CWP. 4" & Less: lock lever handles. 6" & greater: gear operator with handwheel (55-D4E) Kitz 6122EL (Lever) Kitz 6122EG (Gear) Toyo 918BESL (Lever) Toyo 918BESG (Gear) Demco NE Series 22XX5-1145351(285PSIG)
Domestic	Copper	Check	Bronze, soldered, swing, Y pattern 200 psi CWP. Kitz#30.	2-1/2" and 3" same as 2" and smaller. Kitz#30.

NOTES:
1. (*) For drain valves, provide complete with hose end adaptor, cap and chain.
2. Valves based on Crane Manufacturer
   - RS = Rising Stem
   - NRS = Non-Rising Stem

PART 3 – EXECUTION

3.1 TESTING OF DOMESTIC WATER PIPING SYSTEMS

.1 When piping system installation is complete, pressure test all domestic water piping systems as required by the Ontario Building Code.

.2 Provide water pressure test or air pressure test. Water pressure testing shall confirm that piping systems withstand a water pressure of minimum 1000 kPa (145 psi) for minimum 1 hour with no loss of pressure. Air pressure testing shall confirm that piping system withstands an air pressure of minimum 700 kPa (102 psi) for minimum 2 hour with no drop in air pressure.

3.2 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

.1 Prior to starting Work, verify system is complete, flushed and clean. Ensure PH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

.2 Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/l residual.

.3 Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets. Maintain disinfectant in system for 24 hours. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

.4 Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L. Take samples no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry, and analyze.

3.2 INSTALLATION

.1 Piping and Fittings

1 Install piping such that uniform grade is maintained. Install piping with ends aligned and carefully abutted. Install pipe joints in accordance with the recommendations of the respective manufacturer.

2 Ensure that the piping is protected at all times from movement, etc. Ensure piping is kept clean at all times and cap ends during periods when work is stopped.

3 Install piping to conform to building planes. Run parallel to walls and structural components. Conserve headroom at all times and co-ordinate the piping installation with the Work of other Subcontractors and Divisions.

4 Install flanges or unions to isolate each piece of equipment.

5 Provide the necessary chemicals, equipment and labour to clean and disinfect the system to the requirements of all Authorities Having Jurisdiction, including but not limited to plans examiner, building inspector, etc.

.2 Valves

1 Install valves at each piece of equipment, plumbing fixture, at the base of each riser and at any main branch of the piping system.

.3 Water Hammer Arrestors

1 Install arrestors concealed inside partitions.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide complete plumbing and drainage systems, including all necessary labour, services, products, materials and equipment as shown on the Drawings, listed in the equipment schedules on the mechanical Drawings and as specified herein. Products, materials and equipment shall include, but not necessarily be limited to, the following:

.1 Floor drains;

.2 Cleanouts;

.3 Miscellaneous plumbing specialties.

1.2 REFERENCE STANDARDS

.1 Provide all Work in accordance with the latest edition of the Ontario Building Code and the requirements of all local Authorities Having Jurisdiction, including but not limited to plans examiner, building inspector, etc., and all applicable by-laws.

PART 2 - PRODUCTS

2.2 FLOOR AND ROOF DRAINS

.1 Provide all floor drains necessary for a complete installation.

.2 Refer to equipment schedules for details.

2.3 CLEANOUTS AND MISCELLANEOUS

.1 Provide all cleanouts and miscellaneous items necessary for a complete installation.

.2 Refer to equipment schedules for details.

2.4 THERMOSTATIC MIXING VALVES

.1 Complete with check valve, volume control shut-off valve and stem thermometer on outlet, strainer stop check on inlet, mounted in lockable cabinet of 1.5 mm prime coated steel.

2.5 TRAP SEAL PRIMERS

1. Provide trap seal primers for all floor drains including all necessary piping and appurtenances and connect to nearest available domestic cold water supply in accordance with local Authority standards, including but not limited to standards of the plans examiner, building inspector, etc.

PART 3 – EXECUTION

3.1 INSTALLATION

.1 Floor and Roof Drains

1 Install floor drains as required by the Ontario Building Code (“OBC”) and as detailed on the Drawings.

2 Install roof drains as required by OBC and as detailed on the Drawings.

.2 Cleanouts and Miscellaneous

1 Install cleanouts in sanitary and storm drainage piping as required by OBC and all Authorities Having Jurisdiction, including but not limited to plans examiner, building inspector, etc.

2 Install cleanouts at the base of all stacks and at each major change of direction on horizontal pipe runs.

3 Install backflow preventors on all domestic water connections to non-potable water systems. Pipe all relief ports to nearest funnel floor drain.

.3 Trap Primers

1 Install in accordance with manufacturers’ recommendations.
2 Connect to nearest available domestic cold water supply in accordance with local Authority standards, including but not limited to standards of the plans examiner, building inspector, etc.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide plumbing fixtures and trim as listed in the equipment schedules where shown on the Drawings.

1.2 REFERENCE STANDARDS

.1 Perform all Work in accordance with the latest edition of the Ontario Building Code and the requirements of all local Authorities Having Jurisdiction, including but not limited to plans examiner, building inspector, etc., and all applicable by-laws.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES AND TRIM

.1 Provide all plumbing fixtures and trim, including traps, wastes, water connections, etc. necessary for a complete and functional installation.

.2 Plumbing fixtures and trim shall be Products of one manufacturer unless otherwise noted in the Contract Documents or approved by the Consultant.

.3 Plumbing fixtures shall be white unless otherwise noted in the Contract Documents.

.4 All plumbing fixtures and trim shall conform to the latest CSA standards.

.5 Refer to equipment schedules for details.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install new plumbing fixtures and trim. Finished surfaces shall be clean, smooth and bright, and guaranteed not to change colour nor to scale. Imperfections of any kind shall be sufficient reason for rejection by the Consultant and an acceptable replacement shall be installed at no extra cost to the Owner.

.2 Provide cast brass, chrome plated escutcheon plates with set screws on all water and drain pipes passing through walls, floors and partitions.

.3 Plumbing fixture mounting heights to comply with NBCC and CSA B651 Standards.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide electric motors for all mechanical equipment as specified herein.

.2 Provide three phase high efficiency motors where the motor is 0.75 kW (1.0 HP) or greater in size.

1.2 SUBMITTALS

.1 Provide a list of all three phase motors in the Operating and Maintenance Manuals including the following data for each motor.

.1 Size (HP)

.2 Voltage and Phase

.3 Speed (RPM)

.4 Efficiency (%)

.5 Manufacturer

.6 Serial Number

.7 NEMA frame size

PART 2 - PRODUCTS

2.1 GENERAL

.1 All motors up to 0.37 kW (1/2 hp) shall be 120V single phase.

.2 All motors 0.56 kW (3/4 hp) and larger shall be three phase as indicated in the EQUIPMENT SCHEDULES provided on the Drawings.

.3 Motors shall be selected to match the equipment to which they are connected. Motors shall be sized for continuous operation without exceeding the nameplate full load rating, exclusive of service factor.

.4 All motors shall be provided with factory installed nameplates indicating all technical data.

2.2 HIGH EFFICIENCY ELECTRIC MOTORS

.1 Provide high efficiency motors which exceed the efficiencies specified in the NEMA Premium Efficiency Requirements.

.2 Motors for use with variable frequency drives shall have minimum Class F insulation, rated for inverter duty.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Dry out motor if dampness is present in accordance with manufacturer's recommendations.

.2 Install motor so that undue stress is not placed on motor bearings by drive mechanism. Use only lifting facilities provided.

.3 Provide liquid tight polyvinyl chloride (PVC) jacketed flexible conduit between motor and rigid conduit.

.4 Make flexible conduit long enough to permit movement of motor over entire length of slide rails.

.5 Check for correct direction of rotation, with motor uncoupled from driven equipment.

.6 Align and couple motor to driven equipment in accordance with manufacturers' instructions.

.7 Provide unfused lockable disconnect switch for each motor located in accordance with the Electrical Safety Code (CSA C-22.1)

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Division 26 ELECTRICAL includes the provision of power wiring from motor starters to motors.

.2 Division 26 ELECTRICAL includes the provision of power wiring from electrical panels or splitters to loose motor starters.

.3 Division 26 ELECTRICAL includes the provision of power wiring from electrical panels or splitters to packaged control panels.

.4 Division 23 CONTROLS includes the provision of interlock wiring between motor starters.

.5 Division 23 CONTROLS includes the provision of control wiring from motor starters to remote control devices.

.6 Division 23 CONTROLS includes the provision of control wiring from packaged control panels to remote control devices.

.7 Division 23 CONTROLS includes the provision of control wiring for fire alarm fan shutdown from loose fan motor starters to fan shutdown relay in the nearest motor control centre.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Provide all wiring materials in accordance with the requirements of Division 26.

.1 Wiring materials include, but are not limited to, conduit, wire, outlet boxes and wiring devices.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install all wiring in accordance with the requirements of the Electrical Safety Code (CSA C-22.1).

.2 Install all control wiring in conduit. Conceal conduit where possible if not already placed in poured concrete.

.3 The work of Division 26 ELECTRICAL includes provision of unfused disconnect switches for all motors supplied under this Division and where required by the Electrical Safety Code(CSA C-22.1).

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide complete systems, including all necessary labour, services, products, materials and equipment as shown on the Drawings, listed in the Schedules below, and as specified in the Contract Documents. Products shall include, but not necessarily be limited to, the following:

.1 Pipe and fittings.

.2 Valves

1.2 WORK PROVIDED BY OTHERS

.1 Automatic control valves shall be supplied under Section 25 00 00 Controls and installed as part of the work of this Section.

.2 Thermowells shall be supplied under Section 25 00 00 Controls and installed as part of the work of this Section.

1.3 REFERENCE STANDARDS

.1 Provide all work in accordance with the latest applicable codes of CSA and ASTM and the requirements of all local Authorities Having Jurisdiction, including plans examiner, building inspector, and all applicable by-laws.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

.1 Provide pipe and fittings of good quality devoid of any defects and in compliance with the latest ASTM regulations and standards.

.2 Heating Water

1 Schedule 40 black steel.

2 Type 'L' copper.

.3 Condensate Drains

1 DWV copper.

.4 Refer to Schedules below for fittings and methods of joining.

2.2 VALVES

.1 Provide valves that are compatible with the piping and service required.

.2 Valves of each type shall be the product of one manufacturer.

.3 Refer to Schedules below and to Section 23 05 15 for details.

2.3 THERMOWELLS

.1 Install thermowells supplied by controls Subcontractor where applicable. Coordinate locations with control Subcontractor.

2.4 HVAC VALVE SCHEDULE

SYSTEM	PIPING	TYPE	SYSTEMS 50 MM (2") AND SMALLER	SYSTEMS 65 MM (2-1/2") AND LARGER
		Swing Check	Bronze, threaded, swing disc, Y pattern, 200 psi CWP. Similar to Crane #37, Kitz #22, Toyo #236 or Equivalent	
		Silent Check		Install at discharge of pumps in vertical pipes. Cast iron body, wafer type, 316 SS disc and seat, BUNH-N ring and teflon spacer, Class 125. Similar to Grinnell or Equivalent.
		Circuit Balancing Valve (CBV)	Bronze copper alloy construction, threaded, teflon disc ring, 'Y' globe style, c/w hand wheel, division ring scale, drain connection & balancing connector ports with square knob shut-offs. Armstrong CBV I.	Cast iron construction, flanged teflon disc ring, 'Y' globe style c/w hand wheel, division ring scale, balancing connector ports with square knob shut-offs. Armstrong CBV II or Equivalent.
		Eccentric Plug		Cast iron construction, flanged or Victaulic, gear operator with handwheel. Similar to DeZurik Series 100 or Equivalent.
		Angle type combination shut off, balancing and check valve.		Install at discharge of vertical inline pumps. Flanged cast iron body, bronze disc and seat, SS stem and SS spring, multiple turn. Armstrong FTA or Equivalent.
NOTES: SS Stainless Steel RS Rising Stem NRS Non-Rising Stem				

2.5 PIPE JOINTS AND FITTINGS SCHEDULE

PIPE JOINTS AND FITTINGS					
MATERIAL	TYPE			FLANGED	UNIONS
	MECHANICAL	SCREWED	WELDED		
Steel	Provide long radius elbow, malleable iron steel or ductile iron with wall thickness compatible with pipe. Victaulic fitting suitable for groove end pipe for chilled, condensor, glycol and hot water system.	Screwed permitted for all systems 50 mm (2") and under.	Weld all pipe sizes and provide long radius elbows and forged steel fittings of the same weight as the pipe being joined. Provide welding tees threadolets and weldolets on branch connections.	Weld neck or slip on with raised face.	Cast iron with ground joint.
Copper	Cast brass or streamline wrought copper. Provide dielectric fittings when connecting to steel pipe. Braze copper pipe and joints with 95/5 tine/antimony for water systems. For non-pressure drain systems solder with 50/50 tin/lead.			Cast brass or streamline wrought copper. Provide dielectric isolator when connecting to steel.	Cast iron with ground joint. Provide dielectric isolator when connecting to copper.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Piping and Fittings

1 Install piping with ends aligned and carefully abutted. Install pipe joints and fittings in accordance with the recommendations of the respective manufacturer, compatible with the operating pressure of the piping system and in conformance with the latest ANSI standards.

2 Ensure that the piping is protected at all times from movement, etc. Ensure piping is kept clean at all times and cap ends during periods when work is stopped.

3 Ensure that piping is cut true, reamed and cleaned before installation.

4 Ensure that piping and fittings are cleaned, bevelled, aligned and spaced prior to welding.

5 Install piping to conform to building planes. Run parallel to walls and structural components. Conserve headroom at all times and co-ordinate the piping installation with the work of other Subcontractor and Divisions.

6 Install flanges or unions at all connections to equipment. Ensure that all piping, fittings, valves and cleanout devices are accessible.

7 Install a minimum of three (3) elbows at all branch connections or provide a flexible connection.

8 Upfeed branches for heating by means of 45 degree to vertical, then grade up to riser or rise up vertically. Downfeed branches for heating by means of 45degree to vertical, then grade down to vertical drop or drop down vertically.

9 Minimum grade for heating mains and branch supply: 1:50 up in direction of flow and on the return mains and branches grade 1:50 down in direction of flow.

10 Install drain connections as required. Pipe discharge from safety valves, relief valves, overflows, etc., to nearest funnel floor drain.

11 Provide drains at all low points in piping systems terminating with a plugged gate valve.

12 Risers shall be valved where they connect to the mains, and in addition supply and install 20 mm (3/4") drain valves with hose end at the base of all risers.

.13 Provide the necessary chemicals, equipment and labour to clean and disinfect the system to the requirements of all Authorities Having Jurisdiction, including but not limited to plans examiner, building inspector.

.14 Victaulic pipe fittings shall not be permitted in inaccessible spaces.

.2 Valves

1 Install valves at each piece of equipment and where noted on the Drawings.

3.2 WELDING

.1 All welding shall be performed by a certified welder holding a current certificate for the class of pipe to be welded.

.2 Provide all welding and fabrication in accordance with current CSA standards and all Authorities Having Jurisdiction.

.3 Provide adequate fire protection during welding or cutting procedures. Provide welder with a fully charged 10 lb CO^2 fire extinguisher for emergency use.

.4 Provide York Region project manager a minimum advance notice of three Working Days prior to welding activities to ensure by-pass of existing smoke detectors prior to welding.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 The Contractor shall supply and install all motor starters for all motors supplied under this Division.

.2 The Contractor shall supply and install all variable speed drives for motors supplied under this Division.

1.2 SUBMITTALS

.1 Submit Shop Drawings for all variable speed drives in accordance with Section 21 05 01 and including individual schematic wiring diagrams for each starter, including the following data:

.1 EEMAC starter size.

.2 Fuse sizes.

.3 Control transformer size.

.4 Terminations for remote devices.

.5 Interlocking.

.6 Identification of all control components.

.2 Submit revised updated shop drawings for inclusion in the project Operating and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 GENERAL

.1 All starters shall be provided by the same manufacturer.

.2 Identify all starters with lamacoid nameplates indicating equipment designation and service.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install starters, connect wiring as required.

.2 Ensure correct fuses and overload heater elements are installed.

3.2 TESTING

.1 Field test all starter’s after completion of the wiring to verify correct operation.

END OF SECTION

PART 1 - GENERAL

1.1 SHOP DRAWINGS

.1 Submit Shop Drawings in accordance with Section 21 05 01.

.2 Indicate on manufacturer's catalogue literature: expansion tanks, air vents, separators, valves, strainers, and flow meters.

1.2 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 AUTOMATIC AIR VENT

.1 Standard float vent with brass body and NPS 1/8 connection and rated at 690 kPa (100 psi) working pressure.

.2 Industrial float vent with cast iron body and NPS 1/2 connection and rated at 860 kPa (125 psi) working pressure.

.3 Float: solid material suitable for 115 degrees C (240 degrees F) working temperature.

2.2 PIPE LINE STRAINER

.1 NPS 1/2 - 2: bronze body, screwed connections.

.2 NPS 2-1/2 - 12: cast steel body, flanged connections.

.3 Size: as indicated on the Drawings.

.4 Blowdown connection: NPS 1.

.5 Screen: stainless steel with perforation size of 1.6 mm (1/16") to 75 mm (3") and 3.2 mm (1/8") for 100 mm (4") and larger.

.6 Working pressure: 860 kPa (125 psi).

2.3 CIRCUIT BALANCING VALVES (CBV'S)

.1 Each valve shall have two 1\4" NPT brass metering ports with check valves and gasketted caps located on both sides of valve seat. Two additional 1/4" NPT connections with brass plugs are to be provided on the opposite side of the metering ports for use as drain connections. Drain connections and metering ports are to be interchangeable to allow for measurement flexibility when valves are installed in tight locations.

.2 Valves are to be of the "Y" pattern, modified, equal percentage globe style and shall provide the following three functions:

1 Precise flow measurement.

2 Precision flow balancing.

3 Positive drip tight shut off.

.3 Valve shall provide multi-turn, 360° adjustment with a micrometer type indicator located on valve handwheel. Valve handwheel shall have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. 90° turn adjustable valves are not acceptable.

.4 Valve body for 1/2" - 2" valves shall be bronze with ultra-high strength engineered resin plug. The plug shall have precision-contoured channels to distribute flow uniformly across valve seat. Bronze stem and high strength resin handwheel and sleeve. Valves shall have a minimum of four full 360° handwheel turns.

.5 Valve body for 2-1/2" - 12" valves shall be ductile iron with industrial standard grooved ends. Valve stem and plug disc shall be bronze with handwheel with multi-turn handwheel adjustments. Flange adapters shall be supplied, to prevent rotation.

.6 The valve shall be installed with flow in the direction of the arrow on the valve body and installed at least five pipe diameters downstream from any fitting, and at least ten pipe diameters downstream from any pump. Two pipe diameters downstream from the CBV shall be free of any fittings. Mounting of valve in piping must prevent sediment build-up in metering ports.

.7 Each valve shall be furnished with a pre-formed recoverable PVC insulation jacket to meet all required codes, including the Ontario Building Code, with a flame spread rating of 50 or less. Provide mineral fiberglass insulation to meet ASHRAE 90.1-1989 specifications in operating conditions with maximum Fluid Design Operating Temperature Range of 141-200°F and Mean Rating Temperature of 125°F.

PART 3 - EXECUTION

3.1 GENERAL

.1 Install according to piping layout. Pipe drains and blow off connections to nearest drain.

.2 Maintain proper clearance around equipment to permit performance of service maintenance. Check final location with the Consultant if different from that indicated on the Drawings prior to installation.

.3 Should deviations beyond allowable clearances arise, request and follow the Consultant's instructions.

.4 Refer to manufacturer's installation drawings.

.5 Check that all openings for appurtenances and equipment operating weight conform to shop drawings.

.6 If accessories and/or ancillaries are received knocked down, check assembly with the Consultant.

3.2 STRAINERS

.1 Install in horizontal or down flow lines.

.2 Ensure adequate clearance for removal of basket.

.3 Install ahead of each pump (except vertical inline pumps), automatic control valve (larger than 3/4") and as indicated on the Drawings.

3.3 AIR VENTS

.1 Install at high points of systems.

.2 Pipe overflow to nearest drain.

.3 On large-capacity air vent, install gate valve upstream of air vent.

END OF SECTION

PART 1 - GENERAL

2.1 WORK INCLUDED

.1 Provide direct drive or belt drive horizontal fan coil units, where indicated on the Drawings, and of the types and performance as listed in the Schedules on the Drawings.

.2 Fan coils to be complete with Minimum Efficiency Reporting Value (“MERV’)13 filters, internal condensate drain, and overflow drain.

2.2 SUBMITTALS

.1 Submit Shop Drawings for each fan coil unit in accordance with Section 23 05 10 and including the following data:

1 Fan performance at the specified external static pressure at all three speeds.

2 Heating and cooling coil performance at the specified entering air and water conditions at all three speeds.

3 Sound power levels at all three speeds.

.2 Provide data for inclusion in the Operating and Maintenance Manuals in accordance with Section 23 05 10.

2.3 MANUFACTURER CERTIFICATION

.1 Provide manufacturer certification of the installation in accordance with Section 23 05 10.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Fan coil units shall be rated in accordance with the Air Conditioning and Refrigeration Institute ARI standards as a complete package.

.2 Deliver units to the construction site completely assembled and in one piece. Protect casings from damage and cover all pipe and duct connections.

.3 For direct drive units, provide unit mounted speed switch and electrical connection box, all factory wired with "OFF" position suitable for use as a disconnect switch.

2.2 CASING

.1 Construct unit casing of 1.02 mm (20 gauge) galvanized steel, reinforced for rigidity.

.2 Provide insulated return air plenum designed for rear air inlet including filter mounting.

.3 Provide access to fans, motor and filter to permit removal with units installed.

.4 Insulate entire casing, including return air plenum with minimum 12 mm (1/2") thick glass fibre insulation with neoprene coating.

2.3 DRAIN PAN

.1 Provide insulated galvanized steel drain pan under the entire coil section and extending on the connection side sufficiently to permit control valves and return water piping to be mounted above.

.2 Drain pan shall be double wall construction with insulation between inner and outer pans.

.3 Provide copper drain connection at low end, and overflow drain.

.4 Provide insulation on drain pan to comply with NFPA-90A.

2.4 FANS

.1 Provide fans with forward curved, double width wheels, stable pressure curve and low sound power levels.

2.5 FILTER

.1 Provide MERV13 filters mounted in return air plenum.

2.6 WATER COILS

.1 Coils shall be aluminum fin mechanically bonded to copper tubing rated at 1725 kPa (250 psig) working pressure. Fit return connections with manual air vent.

2.7 MOTOR (DIRECT DRIVE UNITS)

.1 Motors shall be Electronically Commutated Motor (“ECM”) type with bronze sleeve type bearings and oil reservoirs directly connected to fan wheels. Motors shall have integral overload protection and the capability of starting at 78% of rated voltage and operating at 90% of rated voltage at a temperature of 10^{o}C (50^{o}F).

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install fan coil units in accordance with the manufacturer's installation instructions.

.2 Support units from the slab with steel hanger rods and neoprene vibration isolators. Adjust mounts so that drain pan slopes to the condensate drain.

.3 Insulate piping up tight to coils including control valves, and securely fasten insulation to casing.

.4 Do not obstruct access to unit for service or filter replacement.

.5 Direct power connection to fan coil units provided as part of the work of the electrical Subcontractor unless otherwise indicated.

.6 Check all units for excessive vibration.

.7 Provide isolation ball valves and unions on chilled and heating water supply and return piping. Mount control valves over drain pan.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide complete systems, including all necessary labour, services, products, materials and equipment as shown on the Drawings, listed in the Schedule below and as specified herein.

.2 Provide and set all sleeves and anchors required to accommodate the work of Division 21, 22 and 23.

.3 Read and be governed by the requirements of Section 23 05 48 - Vibration Isolation.

1.2 REFERENCE STANDARDS

.1 Provide all work in accordance with the latest CSA and ASTM requirements and other applicable codes and the requirements of all local Authorities Having Jurisdiction, including but not limited to plans examiner, building inspector, etc.

PART 2 - PRODUCTS

2.1 PIPE AND EQUIPMENT SUPPORTS

.1 Provide all necessary supports, hangers, racks, stands, pads and platforms required to adequately support the piping system and associated equipment from the structure.

.2 Design bases and supports to carry loads safely under all conditions.

.3 Provide all roof curbs and sleepers for roof mounted equipment. Curbs and sleepers shall be set in place prior to insulation of roof to allow for water proofing and flashing. Provide all necessary concrete or wood shims as required to ensure horizontal installation on sloping roof.

.4 Provide all necessary inserts or beam clamps to connect hanger rods to the structure.

.5 Refer to Schedule below for details of pipe hangers.

.6 Provide angle iron wall brackets with specified hanger to support horizontal piping from wall.

.7 For risers passing through floors, provide riser clamps (similar to Grinnell Fig. 261).

2.2 ANCHORS AND GUIDES

.1 Provide anchors and guides of structural steel as required.

.2 Provide Grinnell Fig. 257 pipe slide assemblies for horizontal pipes or Equivalent.

.3 Provide Flexonics or Equivalent alignment guides for vertical pipes. For pipes 100 mm (4") and smaller, provide guides at every floor or 3 m (10 ft). For pipes larger than 100 mm (4"), provide guides at every second floor or 8 m (25 ft).

2.3 PIPE SLEEVES

.1 Provide pipe sleeves for all penetrations through floors and walls. The work of this Division shall include setting of all required anchors and sleeves to accommodate the work of this Division.

.2 Provide Schedule 40 steel pipe for exterior and interior walls above grade and extra heavy cast iron for exterior walls below grade and waterproofed walls.

.3 Provide extra heavy cast iron or Drain Waste Vent (DWV) copper for waterproof floors. Provide a sleeve extension of 100 mm (4") above finished floor.

2.4 CEILING, WALL AND FLOOR PLATES

.1 Provide, at floors and ceilings, for insulated and uninsulated pipe stamped steel, chrome plated split type, spring loaded with locking screws and concealed hinge.

.2 Provide at walls for uninsulated pipe stamped steel, chrome plated split type, spring loaded with locking screws and concealed hinge. Provide at walls for insulated pipe flat seamed 1 mm (18 gauge) galvanized steel band fitted over insulation and 50 mm (2") outside pipe sleeve.

2.5 FLASHING AND COUNTER FLASHING

.1 Provide flashing and counter flashing for all ducts, pipes, etc., passing through walls, waterproof floors and roofs.

2.6 PIPING EXPANSION

.1 Provide and install piping with all necessary expansion loops, offsets, guides, joints, anchors, etc., as may be required.

.2 Provide expansion joints in steel pipes 50 mm (2") and smaller Equivalent to Flexonics 2-ply stainless steel bellows, internal guides with male ends. Provide in steel pipes 65 mm (2-1/2") and larger 304 stainless steel bellows and all accessories.

.3 Provide expansion joints in copper pipes, Flexonics or Equivalent 2-ply bronze bellows and all accessories.

2.7 PIPE HANGERS AND SPACING SCHEDULE

NOTES:

1. Hanger rods shall be cadmium plated continuous thread with locking nuts (Grinnell Fig. 146 or Equivalent).

2. Provide oversized hangers and galvanized steel insulation protection (Grinnell Fig. 167 or Equivalent) for insulated cold piping.

3. Provide insulation protection saddles (Grinnell Fig. 160 or Equivalent) under all insulated piping supported on roller or trapeze hangers.

4. Provide plastic coated hangers where hangers are in direct contact with copper pipes.

PIPE HANGERS AND SPACING SCHEDULE

HANGER	PIPE SIZE	ROD DIAMETER	HANGER SPACING	
			Copper Pipe	Steel Pipe
Adjustable Ring Type (Grinnell Fig. 269 or)	12 mm and 20 mm ½" and ¾"	10 mm 3/8"	1.5 m 5'	1.5 m 5'
	25 mm 1"	10 mm 3/8"	1.8 m 6'	2.1 m 7'
Adjustable Clevis Type (Grinnell Fig. 260 or 65)	32 mm 1-1/4"	10 mm 3/8"	1.8 m 6'	2.1 m 7'
	40 mm and 50 mm 1-1/2" and 2"	10 mm 3/8"	2.4 m 8'	2.7 m 9'
	65 mm and 75 mm 2-1/2" and 3"	12 mm 1/2"	3.7 m 12'	4.3 m 14'
For uninsulated piping and insulated cold piping: Adjustable Clevis Type (Grinnell Fig. 260) For insulated hot piping: Roller Type (Grinnell Fig. 171)	100 mm and 125 mm 4" and 5"	5/8" 15 mm	N/A	5.2 m 17'
	150 mm 6"	19 mm 3/4"	N/A	5.2 m 17'
	200 mm and 250 mm 8" and 10"	22 mm 7/8"	N/A	5.8 m 19'
	300 mm 12"	22 mm 7/8"	N/A	7 m 23'

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Pipe and Equipment Supports

.1 Provide housekeeping pads 100 mm (4") high from finished floor, extending 100 mm (4") beyond equipment and provide chamferred edges. Provide and install all required hold-down bolts.

.2 Provide support of all suspended equipment from the bottom of the equipment.

.3 All hanger rods shall be vertical, without bends or offsets.

.4 Supply all necessary templates, anchor bolts, inserts and location drawings for the equipment supplied. Supervise the work of installation of the bases.

.2 Flashing and Counter Flashing

.1 Flashing

.1 Provide flashings for mechanical penetration through roof.

.2 Counter Flashing

.1 Provide flashings for mechanical penetration through roof.

.3 Anchors and Guides

.1 Install guides adjacent to loops and expansion joints and adhere to manufacturer's recommendations.

.2 Install a minimum of two (2) guides on each side of loop or expansion joint.

.4 Pipe Sleeves

.1 Provide and seal walls which separate areas of different air pressure with permanently resilient silicone base sealing compound.

.2 Install sleeves concentric with pipe and size sleeves to permit continuity and integrity of insulation through sleeves where required.

.3 Install watertight concrete curb 100 mm (4") high and extend 100 mm (4") beyond pipe at all sleeves extending through floor.

.4 Install sleeves 25 mm (1") beyond the exterior face of wall.

.5 Provide packing of loose fibreglass insulation for all sleeves between pipe and sleeve or insulation and sleeve, and seal both sides.

.6 Provide and seal sleeves with silicone base fire stop system equal to the fire rating of the wall approved by local inspector enforcing the Ontario Building Code.

.7 Seal all vertical sleeves through roofs, mechanical rooms and floors with permanently resilient waterproof silicone base sealing compound.

.5 Piping Expansion

.1 Install expansion loops, offsets, guides, joints, etc., so piping will not be overstressed during expansion and contraction.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide vibration isolation and accessories to achieve the following sound levels:

.1 Office Areas: Noise Criteria (“NC”) 35.

.2 Refer to Vibration Isolation Schedule below for specific requirements of mechanical equipment.

.3 Provide spring hangers for piping as specified herein.

1.2 SHOP DRAWINGS

.1 Submit Shop Drawings in accordance with Section 21 05 01.

.2 Provide separate Shop Drawings for each isolated system complete with performance and Product data.

PART 2 - PRODUCTS

2.1 ELASTOMERIC PADS

.1 Type P1 - neoprene waffle or ribbed; 9 mm (3/8") minimum thickness; 50 durometer; maximum loading 350 kPa (50 psi).

.2 Type P2 - rubber waffle or ribbed; 9 mm (3/8") minimum thickness; 30 durometer natural rubber; maximum loading 415 kPa (60 psi).

.3 Type P3 - neoprene-steel-neoprene; 9 mm (3/8") minimum thickness neoprene bonded to 1.71 mm (14 gauge) steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa (50 psi).

.4 Type P4 - rubber-steel-rubber; 9 mm (3/8") minimum thickness rubber bonded to 1.71 mm (14 gauge) steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa (60 psi).

2.2 ELASTOMERIC MOUNTS

.1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

2.3 ISOLATOR SPRINGS

.1 Design stable springs so that ratio of lateral to axial stiffness is equal to or greater than 1.2 times the ratio of static deflection to working height. Select for 50% travel beyond rated load. Units shall be complete with levelling devices.

.2 Ratio of height when loaded to diameter of spring shall be between 0.8 and 1.0.

.3 Cadmium plated for all installations.

.4 Colour code springs.

2.4 SPRING MOUNT

.1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.

.2 Type M2 - stable open spring; support on bonded 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad.

.3 Type M3 - stable open spring; 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.

.4 Type M4 - restrained stable open spring: supported on bonded 6 mm (1/4") minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.

.5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg (430 lbs) maximum.

.6 Performance as indicated on the Equipment Schedules provided on the Drawings.

2.5 HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degree arc without metal to metal contact.

.2 Type H1 - neoprene - in-shear, molded with rod isolation bushing which passes through hanger box.

.3 Type H2 - stable spring, elastomeric washer, cup with molded isolation bushing which passes through hanger box.

.4 Type H3 - stable spring, elastomeric element, cup with molded isolation bushing which passes through hanger box.

.5 Type H4 - stable spring, elastomeric element with precompression washer and nut with deflection indicator.

.6 Performance as indicated.

2.6 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

.1 Acoustic barriers: between pipe and support, consisting of 25 mm (1") minimum thickness heavy duty duck and neoprene isolation material.

2.7 HORIZONTAL THRUST RESTRAINT

.1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm (3/8").

.2 Arrange restraints symmetrically on either side of unit and attach at centre line of thrust.

2.8 VIBRATION ISOLATION SCHEDULE

VIBRATION ISOLATION SCHEDULE					
EQUIPMENT	BASE		ISOLATOR		REMARKS
	TYPE	THICKNESS mm (in)	TYPE	THICKNESS mm (in)	
Cabinet Fans	N/A	N/A	H2	25.4 (1)	
Vertical In-Line Pumps	N/A	N/A	P3	3.8 (0.15)	
Boilers	N/A	N/A	P3	3.8 (0.15)	

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.

.2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping and ducting passage through walls and floors does not transmit vibrations.

.3 Unless indicated otherwise in the Contract Documents, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm (1") minimum static deflection as follows:

.1 Up to Nominal Pipe Size (“NPS”) 4: first 3 points of support.

.2 NPS 5 to NPS 8: first 4 points of support.

.3 NPS 10 and over: first 6 points of support.

.4 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50 mm (2").

.4 Where isolation is bolted to floor, avoid short circuiting of sound pads by using vibration isolation rubber washers.

Block and shim level all bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide a complete system of identification.

1.2 EQUIPMENT

.1 Manufacturer's Nameplates

.1 Provide metal nameplates on each piece of equipment, mechanically fastened with raised or recessed letters.

.2 Provide Underwriters' Laboratories and CSA registration plates, as required by respective agency.

.3 Manufacturer's nameplate to indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.

.4 Locate nameplates so that they are easily read. Do not insulate or paint over plates.

.2 System Nameplates

.1 Provide laminated plastic plates with black face and white centre of minimum size 90 X 40 X 2.5 mm (3-1/2" X 1-1/2" X 1/8") nominal thickness, engraved with 6 mm (1/4") high lettering. Use 25 mm (1") lettering for major equipment.

.2 Fasten nameplates securely in conspicuous place. Where nameplates cannot be mounted on cool surface, provide standoffs.

.3 Identify equipment designation and number.

.4 Submit list of nameplates to the Consultant for review prior to engraving.

1.3 PIPING

.1 Identify medium in piping with markers showing name and service, including temperature, pressure and directional flow arrows in accordance with CGSB 24-GP-3a.

.2 Conform to CGSB 1-GP-12c.Colour Coding System Schedule for new buildings.

.3 Primary colour paint to conform to CGSB 1-GP-60M.

.4 Manufactured pipe markers and colour bands:

.1 Plastic coated cloth material with protective overcoating and waterproof contact adhesive undercoating, suitable for continuous operating temperature of 150 degrees C (302 degrees F) and intermittent temperature of 200 degrees C (392 degrees F). Apply to prepared surfaces.

.2 50 mm (2") wide tape single wrap around pipe or pipe covering with ends overlapping one pipe diameter but not less than 25 mm (1") for colour bands.

.3 Block capital letters 50 mm (2") high for pipes of 75 mm (3") nominal and larger outside diameter (including insulation) and not less than 20 mm (3/4") high for smaller diameters.

.4 Direction arrows 150 mm (6") long by 50 mm (2") wide for piping of 75 mm (3") nominal or larger outside diameter including insulation, and 100 mm (4") long by 20 mm (3/4") wide for smaller diameters. Use double headed arrows where direction of flow is reversible.

.5 Waterproof and heat resistant plastic marker tags for pipes and tubing 20 mm (3/4") nominal and smaller.

.6 Black pipe marker letters and direction arrows, white on red background for fire protection markers.

.5 Identify piping with full description of medium using only abbreviations indicated in the Legend on the Drawings.

.6 Location

.1 Locate markers and classifying colours on piping systems so they can be seen from floor or platform.

.2 On each piping run at least once in each room.

.3 Maximum 15 m (50') between identifications in open areas.

.4 Both sides where piping passes through walls, partitions and floors.

.5 At point of entry and leaving, where piping is concealed in pipe chase or other confined space, and at each access opening.

.6 At start and end points of runs and at each piece of equipment.

.7 At major manual and automatic valves immediately upstream of valves.

.8 Identify branch, equipment or building served after valve.

1.4 DUCTWORK

.1 Use 50 mm (2") high black stencilled letters (eg. "Supply Air", "Return Air", "Sanitary Exhaust", "General Exhaust") with directional flow arrow.

.2 Maintain maximum 15 m (50') distance between markings.

.3 Identify ducts on each side of dividing walls or partitions and beside each access door.

.4 Stencil over final finish only.

1.5 VALVES AND CONTROLLERS

.1 Provide brass tags with 12 mm (1/2") stamped code lettering and numbers filled with black paint, secured with non-ferrous chains or "S" hooks for valves and operating controllers except at plumbing fixtures and radiation and except in plain sight of equipment they serve.

.2 Provide the Consultant with six identification flow diagrams of approved size for each system. Include tag schedule, designating number, service, function, and location of each tagged item and normal operating position of valves.

.3 Install where directed by the Consultant one copy of flow diagram and valve schedule mounted in glazed frame. Provide one copy in each operating and maintenance manual.

.4 Consecutively number valves in systems.

1.6 FAN COIL UNITS

.1 Provide label of t-bar at locations of ceiling mounted fan coil units to indicate fan coil location for filter and valve maintenance.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide testing, adjusting, balancing (TAB) and commissioning of all systems. Commissioning shall include putting into service, adjusting, calibrating and verifying all systems.

.2 Provide the services of an independent balancing company, acceptable to the Consultant, to test, balance and adjust the air and water systems.

.3 Comply with all applicable ASHRAE HVAC Systems and Applications, Testing, Adjusting and Balancing and Associated Air Balance Council (AABC) Standards.

.4 Provide one (1) copy of the balancing report to the Consultant for review. Rebalance any systems which are not operating as intended following remedial work directed by the Consultant. Include all revisions in the final balancing report. Submit three (3) copies of the final report to the Consultant.

.5 Provide one (1) copy of the balancing report to the Commissioning Agent for review. Rebalance any systems which are not operating as intended following remedial work directed by the Commissioning Agent. Include all revisions in the final balancing report. Submit one (1) copy of the final report to the Commissioning Agent.

.6 Notify Commissioning Agent 14 Working Days prior to start of TAB to allow for Commissioning Agent to witness TAB procedures and testing.

.7 Prior to commencing the work, identify all deficiencies in the mechanical systems which will affect the performance or accuracy of the work. Balance systems as they are available to meet the schedule for project completion.

PART 3 - EXECUTION

2.1 FLUID SYSTEMS

.1 Test all fluid systems as follows:

1 Plumbing systems to the Ontario Building Code (“OBC”) requirements.

2 Fire protection systems to OBC requirements.

3 All systems not covered by OBC to 150% of working pressure, but not less than 1035 kPa (150 psig) or the maximum working pressure of expansion joints or isolators, for 24 hours.

.2 Provide balancing and adjusting of all hydronic systems to achieve specified flow rates to within 5% of design flow rates.

.3 Provide data in the balancing report which indicates flow rates, motor data, operating curves, operating temperatures and operating pressures for all pumps, coils and heat exchangers.

.4 Mark balancing valves indicating the balanced position.

.5 Verify operation of all control valves including perimeter heating.

2.2 AIR SYSTEMS

.1 Provide balancing and adjusting of all air systems to achieve specified design values (±5%).

.2 Provide data in the balancing report which indicates air volumes at each outlet, static pressures, fan data, motor data and coil data.

.3 Provide duct traverse readings for each air handling unit and fan (with ducted connections and exceeding 1000 cfm).

.4 Identify pressure drop across filters for all air handling units.

.5 Adjust the air pattern for all diffusers as indicated on the Drawings or as directed by the Consultant.

.6 Verify the operation of all control devices.

2.3 EQUIPMENT

.1 Provide balancing, testing and adjusting of all equipment.

.2 Include the following data in the balancing report:

1 Electrical characteristics.

2 Flow rates (air).

3 Operating pressures and pressure drops.

4 Operating efficiencies.

2.4 REPORTS

.1 Submit all reports and forms to the Consultant for approval prior to any testing, balancing and adjusting. The forms shall be modified if they are not acceptable to the Consultant.

.2 Submit all reports and forms to the Commissioning Agent for approval prior to any testing, balancing and adjusting. The forms shall be modified if they are not acceptable to the Commissioning Agent.

.3 Provide all data required for evaluation of the work of this Section.

.4 Provide schematic drawings of each system indicating points at which readings have been obtained.

2.5 DEMONSTRATION

.1 Provide the demonstration of all systems and equipment, including complete documentation of the operating procedures of each system or piece of equipment. The time allotted for demonstration shall be adequate for the complexity of the systems and shall be acceptable to the Consultant.

2.6 TRIAL USAGE

.1 Provide operation of all systems for purposes of demonstration and training of operating personnel. Trial usage does not constitute acceptance by the Owner.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide all thermal insulation and accessories for ducting of the types and thicknesses indicated in the Insulation Schedule contained in Section 23 07 15.

.2 All supply air ductwork from fan coil units shall be insulated.

1.2 REFERENCE STANDARDS

.1 Meet the requirements of NFPA 90A. Maximum flame spread rating of 25 and maximum smoke developed rating of 50 in accordance with NFPA 255 and CAN4-S102 for all components of insulation system. Materials shall be tested in accordance with ASTM C411-82.

1.3 SAMPLES SUBMITTALS

.1 Submit for the Consultant's approval, a complete assembly of each type of insulation system, insulation, coating and adhesive proposed. Mount samples on 12 mm (1/2") plywood board. Label each sample indicating type.

1.4 DEFINITIONS

.1 For purposes of this Section:

.1 "CONCEALED" shall mean insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred spaces.

.2 "EXPOSED" shall mean "not concealed" as defined herein.

PART 2 - PRODUCTS

2.1 D-1 MINERAL FIBRE BLANKET 20 degrees C TO 65 degrees C (68 degrees F TO 150 degrees F)

.1 Material:

.1 CGSB 51-GP-11M mineral fibre blanket.

2.2 D-2 MINERAL FIBRE BLANKET WITH VAPOUR BARRIER -40 degrees C TO 65 degrees C (-40 degrees F TO 150 degrees F)

.1 Material:

.1 CGSB 51-GP-11M mineral fibre blanket: CGSB 51-GP-52M for vapour barrier.

2.3 D-3 MINERAL FIBRE RIGID 20 degrees C TO 65 degrees C (68 degrees F TO 150 degrees F)

.1 Material:

.1 CGSB 51-GP-10M, rigid mineral fibre board.

2.4 D-4 MINERAL FIBRE RIGID WITH VAPOUR BARRIER TO 65 degrees C (150 degrees F)

.1 Material:

.1 CGSB 51-GP-10M, rigid mineral fibre board: CGSB 51-GP-52M vapour barrier jacket and facing material.

2.5 FASTENINGS

.1 Tape: self-adhesive, 100 mm (4") wide.

.2 Contact adhesive: quick-setting.

.3 Lap seal adhesive: quick-setting for joints and lap sealing of vapour barriers.

.4 For canvas:

.1 Washable adhesive for cementing canvas lagging cloth to duct insulation.

.5 Pins:

.1 Weld pins 4 mm (1/8") in diameter, with 35 mm (1.5") diameter head for installation through the insulation. Length to suit thickness of insulation.

.2 Weld pins 2 mm (1/16") in diameter, for installation prior to applying insulation. Length to suit thickness of insulation. Nylon retain clips 32 mm (1.5") square.

2.6 JACKETS

.1 Canvas:

.1 Apply in exposed areas: ULC listed plain weave, cotton fabric at 220 g/sq. m (6.5 oz./sq. yd).

PART 3 - EXECUTION

3.1 APPLICATION

.1 Apply insulation after required tests have been completed and approved by the Consultant. Insulation and surfaces shall be clean and dry when installed and during application of any finish. Apply insulation materials, accessories and finishes to manufacturer's recommendations and as specified in the Contract Documents.

.2 Vapour barriers and insulation to be unbroken over full length of duct or surface, without penetration for hangers, standing duct seams and without interruption at sleeves.

.3 Use stand-offs for all duct-mounted control accessories.

.4 Apply 1.0 mm (18 gauge) thick galvanized sheet metal corners to all ductwork in mechanical rooms.

3.2 INSTALLATION

.1 General

.1 Adhere and seal vapour barrier using vapour seal adhesives.

.2 Stagger longitudinal and horizontal joints on multi-layered insulation.

.2 Mechanical Fastenings

.1 On rectangular ducts, use 50% coverage of insulating cement and weld pins at not more than 200 mm (8") centres, but not less than two (2) rows per side and bottom.

.3 Apply canvas jacket in all exposed areas.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

1 Provide all thermal insulation and accessories for ducting, piping, and equipment of the types and thicknesses indicated in the following Insulation Schedule.

.2 Refer to Specification Sections 23 07 13, 23 07 20, 23 05 14, and 23 05 15 for additional details.

.3 Increase thickness of piping insulation to 50 mm (2”) where piping over 50 mm (2”) is electrically traced.

INSULATION SCHEDULE

ITEM	TYPE	THICKNESS mm (in)	COMMENTS
Domestic Cold Water	P-2	25 (1)	
Domestic Hot Water Supply and Recirculating (2"Ø and Below)	P-1	25 (1)	
Domestic Hot Water Supply and Recirculating (Above 2"Ø)	P-1	40 (1-1/2)	
Chilled Water Supply and Return	P-2	40 (1-1/2)	
Heating Water Supply and Return	P-1	40 (1-1/2)	
Condensate Drains from Cooling Coils	P-2	25 (1)	
Supply Air Duct - Round	D-2	25 (1)	All ductwork within concealed ceiling spaces and shafts
Supply Air Duct - Rectangular	D-2	25 (1)	All ductwork within concealed ceiling spaces and shafts

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide all thermal insulation and accessories for piping.

.2 Refer to the Insulation Schedule (Section 23 07 15) for piping to be insulated, insulation type and thickness.

.3 Insulate all associated fittings and valves.

1.2 REFERENCE STANDARDS

.1 Meet the requirements of NFPA 90A-1985. Maximum flame spread rating of 25 and maximum smoke developed rating of 50 in accordance with NFPA 255 and CAN4-S102 for all components of insulation system. Materials tested in accordance with ASTM C411.

1.3 SAMPLES

.1 Submit for the Consultant's approval a complete assembly of each type of insulation system, insulation coating and adhesive proposed. Mount samples on minimum 12 mm (1/2") plywood board. Label each sample indicating type.

1.4 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" shall mean insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred spaces.

.2 "EXPOSED" shall mean "not concealed" as defined herein.

PART 2 - PRODUCTS

2.1 P-1 FORMED MINERAL FIBRE TO 200 degrees C (392 degrees F)

.1 Material:

.1 CGSB 51-GP-9M, rigid mineral fibre sleeving for piping.

2.2 P-2 FORMED MINERAL FIBRE WITH VAPOUR BARRIER TO 85 degrees C (185 degrees F)

.1 Material:

.1 CGSB 51-GP-9M, rigid mineral fibre sleeving for piping and CGSB 51-GP-52M, vapour barrier jacket and facing material.

2.3 P-3 FLEXIBLE MINERAL FIBRE WITH VAPOUR BARRIER TO 85 degrees C (185 degrees F)

.1 Material:

.1 CGSB 51-GP-11M, mineral fibre blanket for piping and CGSB 51-GP-52M vapour barrier jacket and facing material.

2.4 P-4 FLEXIBLE ELASTOMERIC -40 degrees C TO 100 degrees C (-40 degrees F TO 212 degrees F)

.1 Material:

.1 CAN2-51.40-M80 Aug-83, flexible elastomeric unicellular sheet and pipe covering.

2.5 FIRE RATED THERMAL PIPE INSULATION

.1 Equivalent to "Instant Firestop Inc." type "PI".

.2 ULC listed as a component of a fire stop system complete with vapour barrier jacket.

2.6 FASTENINGS

.1 For insulation systems P-1, P-2, P-3:

.1 Tape: self-adhesive.

.2 Lap seal adhesive: quick-setting for joints and lap sealing of vapour barriers.

.2 For insulation system P-4 and underside of roof drain body:

.1 Contact adhesive: quick-setting for seams and joints.

.2 Tape: self-adhesive Polyvinyl Chloride (PVC).

.3 For canvas:

.1 Washable adhesive for cementing canvas lagging cloth to piping insulation.

2.7 INSULATION CEMENT

.1 To CGSB 51-GP-6M.

2.8 JACKETS

.1 PVC

.1 Apply in accordance with CGSB 51-GP-53M only when specified.

.1 0.38 mm (28 gauge) thick minimum.

.2 Fitting covers, one piece premoulded to match.

.3 Fastenings standard to manufacturer.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Apply insulation after required tests have been completed and approved by the Consultant. Insulation and surfaces shall be clean and dry when installed and during application of any finish. Apply insulation materials, accessories and finishes in accordance with manufacturer's recommendations and as specified in the Contract Documents.

.2 On piping with insulation and vapour barrier, install high density insulation under hanger shield. Maintain integrity of vapour barrier over full length of pipe without interruption at sleeves, fittings and supports.

.3 On piping with insulation and vapour barrier that passes through a fire separation (wall, floor slab, etc.), provide fire rated thermal insulation to maintain continuity of vapour barrier and insulation without violating the integrity of the fire separation. Fire rated insulation shall be installed as part of a ULC listed fire stop system to provide the same rating as the fire separation.

.4 Apply PVC jacket to all exposed piping insulation located indoors unless otherwise indicated in the Contract Documents. PVC jacket is not required for chrome plated sections of water and drain piping, only for non-chrome plated piping sections.

3.2 INSTALLATION

.1 Preformed: sectional up to NPS 12, sectional or curved segmented greater than NPS 12.

.2 Multi-layered: staggered butt joint construction.

.3 Vertical pipe greater than NPS 3: insulation supports welded or bolted to pipe directly above lowest pipe fitting. Thereafter, locate on 4.5 m (15') centres.

.4 Expansion joints: terminate single layer and each layer of multiple layers in straight cut. Leave space of 25 mm (1") between terminations. Pack void tightly with mineral fibre. Protect joints with stainless steel or aluminum sleeves.

.5 Terminate insulation with insulation cement.

.6 Bevel away for studs and nuts to permit their removal without damage to insulation, and seal with insulating cement.

.7 Insulation is not required for chrome plated piping, valves and fittings.

.8 Provide removable sections of insulation for fittings or devices requiring routine maintenance such as strainers.

3.3 FASTENINGS

.1 Secure pipe insulation by tape at each end and centre of section, but not greater than 900 mm (36") on centres.

END OF SECTION

PART 1 – GENERAL

1.1 General

.1 The purpose of this section is to specify responsibilities in the commissioning process for the work of Division 23.

.2 The systems to be commissioned are listed in Section 01 91 00, subsection.1.9. The abbreviations and definitions used in Section 01 91 00 apply to this Section 23 08 00 – HVAC System Commissioning.

.3 Commissioning shall take into account the requirements under Division 23 to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 01 91 00. For the purposes of completing work under Division 23, the Contractor shall be familiar with all parts of Section 01 91 00 and the commissioning plan issued by the CA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.2 Responsibilities

.1 Mechanical Subcontractor. The responsibilities of the Contractor and its HVAC Subcontractor, during construction and acceptance phases in addition to those listed above are (all references apply to commissioned equipment only):

.1 Documentation of all procedures performed shall be provided and forwarded to the Consultant. Written documentation must contain recorded test values of all mechanical tests performed per the individual product specification.

.2 The start-up service company shall be present during energization of the mechanical equipment. Jobsite and equipment access must be provided by the Mechanical Subcontractor.

.3 Supply a power source, specified by the start-up service company, for on-site test equipment.

.4 Attend all factory witness testing required within the respective specification sections. The Contractor shall include all related costs in the total Contract Price submitted with its bid.

.5 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.6 The Contractor shall Include the cost of commissioning in the total Contract Price, submitted with its bid..

.7 The Contractor shall ensure it complies with the requirements of GC -10 Subcontractors and ensures that the Mechanical Subcontractor complies with the Contract requirements for submittal data, O&M data and training.

.8 Attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process.

.9 Provide normal cut sheets and shop drawing submittals to the CA of commissioned equipment. Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of pre-functional and functional testing procedures.

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

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

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

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

.12 Provide assistance to the CA in preparation of the specific functional performance test procedures specified in Division 23. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

.13 Develop a full start-up and checkout plan using manufacturer's start-up procedures and the pre-functional test sheets from the CA. Submit manufacturer's detailed start-up procedures and the full start-up plan and procedures and other requested equipment documentation to CA for review.

.14 During the start-up and checkout process, execute and document the mechanical-related portions of the pre-functional test sheets provided by the CA for all commissioned equipment.

.15 Perform and clearly document all completed start-up and system operational checkout procedures, providing a copy to the CA.

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

.17 Perform functional performance testing under the direction of the CA for specified equipment in Section 01 91 00, subsection 1.9. Assist the CA in interpreting the monitoring data, as necessary.

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

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

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

.21 Provide training of the Owner's operating personnel as specified in the Contract Documents.

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

.23 Execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.

.24 Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

.25 Assist and cooperate with the TAB Subcontractor and CA by:

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

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

.3 Providing test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing. Providing an approved plug.

.4 Providing temperature and pressure taps according to the Construction Documents for TAB and commissioning testing.

.26 Install a Pressure Transducer (P/T) plug at each water sensor which is an input point to the control system.

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

.28 Prepare a preliminary schedule for pipe to be installed under Division 23 and duct system testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the CA. Update the schedule as appropriate.

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

.2 TAB Subcontractor: The duties of the TAB Subcontractor, in addition to those listed in 1.2.1 are:

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

.2 Submit the outline of the TAB plan and approach for each system and component to the CA, PM/GC and the Controls Subcontractor six weeks prior to starting the TAB. This plan will be developed after the TAB has some familiarity with the control system. The submitted plan will include:

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

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

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

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

.5 Final test report forms to be used.

.6 Detailed step-by-step procedures for TAB work for each system and issue: terminal flow calibration (for each terminal type), diffuser proportioning, branch / submain proportioning, total flow calculations, rechecking, diversity issues, expected problems and solutions, etc. Criteria for using air flow strengtheners or relocating flow stations and sensors will be discussed. Provide the analogous explanations for the water side.

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

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

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

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

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

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

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

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

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

.16 Details of any TAB work to be done in phases (by floor, etc.), or of areas to be built out later.

.17 Details regarding specified deferred or seasonal TAB work.

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

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

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

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

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

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

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

.4 Communicate in writing to the Controls Subcontractor all setpoint and parameter changes made, or problems and discrepancies identified during TAB which affect the control system setup and operation.

.5 Provide a draft TAB report within 10 Working Days of completion of commissioning. A copy will be provided to the CA. The report will contain a full explanation of the methodology, assumptions and the results in a clear format with designations of all uncommon abbreviations and column headings. The report should follow the latest and most rigorous reporting recommendations by AABC, NEBB.

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

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

.8 Conduct functional performance tests and checks on the original TAB as specified for TAB in Section 23 05 93.

PART 2- PRODUCTS

.1 NOT USED

PART 3- EXECUTION

3.1 Submittals

.1 Provide submittal documentation relative to commissioning to the CA as requested by the CA. Refer to Section 01 91 00 Part 3.3 for additional Section 23 requirements.

3.2 Start-up of Equipment

.1 Follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in 01 91 00. Ensure the start-up responsibility under Division 23 is met and complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning agent or Owner.

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

.3 Prior to the start up of equipment under Division 23 the Contractor shall arrange to have the manufacturer of all major equipment inspect the installation to ensure their equipment has been installed in accordance with their recommendations.

.4 The supplier shall submit a written report of their findings.

.5 Upon confirmation that the equipment has been installed in accordance with the Manufacturers Recommendations the equipment may be started.

.6 All equipment shall be started by the manufacturer’s representative.

3.3 Pre-Functional Test Sheets

.1 Pre-functional test sheets contain items to be performed under Division 23. On each checklist, a column is provided that is to be completed by the contractor assigning responsibility for that line item to a trade. Those executing the test sheets are only responsible to perform items that apply to the specific application at hand. These test sheets do not take the place of the manufacturer's recommended checkout and start-up procedures or report. Some checklist procedures may be redundant in relation to checkout procedures that will be documented on typical factory field checkout sheets. Double documenting may be required in those cases.

.2 Refer to Section 01 91 00 for additional requirements regarding pre-functional test sheets, start-up and initial checkout. Items that do not apply should be noted along with the reasons on the checklist. If this checklist is not used for documenting, one of similar rigor and clarity shall be used pending approval from the CA. Contractor's assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off. "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = Architect/Engineer, All = Contractor including all Subcontractors, CA = Commissioning Agent, CC = Controls Subcontractor, EC = Electrical Subcontractor, PM/GC = General Contractor, MC = Mechanical Subcontractor, SC = Sheet Metal Subcontractor, TAB = Test and Balance Subcontractor.

3.4 Operations and Maintenance Manuals

.1 Compile and prepare documentation for all equipment and systems covered in Division 23 and deliver to the GC for inclusion in the O&M manuals

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

3.5 Training of Owner Personnel

.1 The GC shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed. Refer to Section 01 91 00 for additional details.

.2 The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment. Refer to Section 01 91 00 for additional details.

.3 Mechanical Subcontractor. The mechanical contractor shall have the following training responsibilities:

.1 Provide the CA with a training plan two weeks before the planned training according to the outline described in Section 01 91 00, Part 3.8.

.2 Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, pumps, boilers, furnaces, chillers, heat rejection equipment, air conditioning units, air handling units, fans, terminal units, controls and water treatment systems, etc.

.3 Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including start-up, shutdown, fire/smoke alarm, power failure, etc.

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

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

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

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

.8 Training shall include:

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

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

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

.4 Discussion of warranties and guarantees.

.5 Common troubleshooting problems and solutions.

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

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

.9 The format and training agenda in The HVAC Commissioning Process, ASHRAE Guideline 0-2005 is recommended.

.10 Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.

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

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

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

3.6 Deferred Testing

.1 Refer to Section 01 91 00, Part 3.9 for requirements of deferred testing.

3.7 WRITTEN WORK PRODUCTS

.1 Written work products under Division 23 shall consist of the start-up and initial checkout plan as described in Section 01 91 00, as well as completed start-up, initial checkout and pre-functional test sheets.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide all low pressure ductwork and accessories as shown on the Drawings.

PART 2 - PRODUCTS

2.1 CLASSIFICATION

.1 Ductwork

Class	Maximum Pressure Pa ("Water Gauge)	Maximum Velocity Class m/s (fpm)	Seal
I	500 (2)	12.5 (2500)	A
II	250 (1)	12.5 (2500)	B
III	125 (0.5)	10.0 (2000)	C

.2 Seals

1 Class A: seams, joints and connections made airtight with sealing compound and tape.

2 Class B: seams, joints and connections made airtight with sealing compound.

3 Class C: transverse joints and connections made airtight with sealing compound. Longitudinal seams unsealed.

2.2 SEALANT AND TAPE

.1 Sealant: oil resistant, polymer type flame resistant high velocity duct sealing compound. Temperature range of -30 degrees C to 93 degrees C (-22 degrees F to 200 degrees F).

.2 Tape: polyvinyl treated, open weave glass fibre tape, 50 mm (2") wide.

2.3 DUCT LEAKAGE

.1 Class I: 0.50% of total system design flow at 500 Pa (2" W.G.).

.2 Class II: 1.00% of total system design flow at 250 Pa (1" W.G.).

.3 Class III: 1.50% of total system design flow at 125 Pa (1/2" W.G.).

.4 Class IV: 5.00% of total system design flow at 125 Pa (1/2" W.G.).

2.4 FITTINGS

.1 Fabrication: to SMACNA standards

.2 Radius elbows: standard radius or short radius with single thickness turning vanes.

.3 Square elbows: to 400 mm (16") with single thickness vanes.

.4 Square elbows: over 400 mm (16") with double thickness vanes.

.5 Main supply duct branches with or without splitter damper. If splitter damper is not used, provide branch and main duct balancing dampers.

.6 Sub-branch duct with 45 degree entry and balancing damper on branch, or sub-branch duct with square connection, volume extractor and branch duct balancing damper.

.7 Transitions:

1 Diverging: 20 degree maximum included angle.

2 Converging: 30 degree maximum included angle.

.8 Offsets: square elbows or radius elbows as indicated on the Drawings.

.9 Obstruction deflectors: maintain full cross-sectional area. Maximum included angles for transitions.

2.5 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A525M-80, Z90 zinc coating.

.2 Thickness: to ASHRAE and SMACNA.

.3 Fabrication: to ASHRAE and SMACNA.

.4 Joints: to ASHRAE and SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint shall be considered to be a Class A seal.

.5 All round exposed ductwork shall be of spiral wound manufacture.

2.6 HANGERS AND SUPPORTS

.1 Strap hangers: of same material as duct, but next sheet metal thickness heavier than duct.

.2 Hanger configuration: to ASHRAE and SMACNA. Maximum size duct supported by strap hanger: 500 mm (20").

.3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA, In accordance with the following table:

Duct Size mm (")	Angle Size mm (")	Rod Size mm (")
up to 750 (30)	25 x 25 x 3 (1 x 1 x 1/8)	6 (1/4)
751 (30) to 1050 (42)	40 x 40 x 3 (1.5 x 1.5 x 1/8)	6 (1/4)
1051 (42) to 1500 (60)	40 x 40 x 3 (1.5 x 1.5 x 1/8)	10 (3/8)
1501 (60) to 2100 (84)	50 x 50 x 3 (2 x 2 x 1/8)	10 (3/8)
2101 (84) to 2400 (96)	50 x 50 x 5 (2 x 2 x 3/16)	10 (3/8)
2401 (96) and over	50 x 50 x 6 (2 x 2 x 1/4)	10 (3/8)

.4 Upper hanger attachments:

0.1 For concrete: manufactured concrete inserts.

PART 3 - EXECUTION

3.1 GENERAL

.1 Install ducts in accordance with ASHRAE and SMACNA.

.2 Provide all duct supports in accordance with SMACNA standards. Maximum duct sag shall be limited to ½ inch per foot.

.3 All HVAC ductwork and equipment, including existing equipment, shall be protected from exposure to moisture and from collecting dust, debris, odours and other contaminants while demolition and construction activities are ongoing.

.4 The ends of all ductwork and openings in HVAC equipment are to be sealed tightly, whether they are installed or being stored prior to installation. All ductwork and equipment that is waiting to be installed must be kept off the floor a minimum of 75 mm.

.5 Provide adequate access into ductwork for cleaning purposes.

.6 Immediately after installation, the open ends of return and exhaust ductwork shall be sealed with 6-mil plastic.

.7 HVAC equipment and ductwork left in place during demolition and construction shall be wrapped in 6-mil plastic sheeting.

.8 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm (4") beyond insulated duct.

.9 Support risers in accordance with ASHRAE and SMACNA, or as indicated on the Drawings.

.4 Unless otherwise indicated on the Drawings, ductwork shall be constructed of galvanized steel.

.5 All supply and exhaust ductwork shall be Seal Class C. All other ductwork shall be Class I, Class II or Class III as required.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing as follows:

Duct Size mm (")	Spacing mm (')
to 1500 (60)	3000 (10)
1501 (60) and over	2500 (8)

3.4 SEALING AND TAPING

.1 Apply sealant to outside of joint in accordance with manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one (1) red coat of sealant in accordance with manufacturer's recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide all duct accessories.

1.2 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

PART 2 - PRODUCTS

2.1 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 1.5 mm (16 gauge) thick with fabric clenched by means of double locked seams.

.2 Material: Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at -40°C to 90°C (-40°F to 194°F), density of 1.3 kg.sq. m (25 lbs/sq.ft).

2.2 SEALANT AND TAPE

.1 Sealant: oil resistant, polymer type flame resistant high velocity duct sealing compound. Temperature range of -30°C to 93°C (-22°F to 200°F).

.2 Tape: polyvinyl treated, open weave fibre glass tape, 50 mm (2") wide.

2.3 ACCESS DOORS

.1 General

1 Non-insulated sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (24 gauge) thick, complete with sheet metal angle frame.

2 Insulated sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm (24 gauge) thick, complete with sheet metal angle frame and 25 mm (1") thick rigid glass fibre insulation.

.2 Gaskets: neoprene or foam rubber.

.3 Hardware:

1 Up to 300 mm x 300 mm (12" x 12"): two (2) sash locks.

2 301 mm to 450 mm (12" to 18"): four (4) sash locks.

3 451 mm to 1000 mm (18" to 40"): piano hinge and minimum two (2) sash locks.

4 Doors greater than 1000 mm (40"): piano hinge and two (2) handles operable from both sides.

2.4 TURNING VANES

.1 Factory or shop fabricated, single or double thickness in accordance with the recommendations of SMACNA.

2.5 INSTRUMENT TEST PORTS

.1 1.6 mm (14 gauge) thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm (1") minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.6 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, and centre pivoted.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Flexible Connections

1 Install in following locations:

1 Inlets to supply air units, except where units are internally isolated.

2 Outlets from supply air units except where units are internally isolated.

3 Inlets and outlets of fans.

4 As indicated on the Drawings.

2 Length of connection: 150 mm (6").

3 Minimum distance between metal parts when system in operation: 75 mm (3").

4 Install in accordance with recommendations of SMACNA.

.2 Sealants and tapes

1 Apply sealant in accordance with recommendations of SMACNA and the manufacturer.

2 Bed tape in sealant and recoat with minimum of one coat of sealant in accordance with the

manufacturer's recommendations.

.3 Access doors

1 Size:

1 760 mm x 1500 mm (30" x 60") for person size entry.

2 600 mm x 1200 mm (24" x 48") for servicing entry.

3 300 mm x 300 mm (12" x 12") for viewing.

4 As indicated on the Drawings.

2 Location

1 At fire and smoke dampers.

2 At control dampers.

3 At devices requiring maintenance.

4 At locations required by the Ontario Building Code.

5 As indicated on the Drawings.

.4 Instrument Test Ports

1 General

1 For traverse readings, install in accordance with recommendations of SMACNA.

2 For temperature readings, install in accordance with recommendations of SMACNA.

3 Install in accordance with manufacturer's instructions.

2 Locations

1 Traverse:

1 At ducted inlets to roof and wall exhausters.

2 At inlets and outlets of other fan systems.

3 At main and sub-main ducts.

4 As indicated or required for full, accurate readings.

2 Temperature:

1 At outside air intakes.

2 At mixed air locations.

3 At inlet and outlet of coils.

4 Downstream of junctions of two converging air streams of different temperatures.

5 As indicated on the Drawings or required for all necessary readings.

.5 Turning vanes

1 Install in accordance with recommendations of SMACNA.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide all balancing dampers and accessories.

PART 2 - PRODUCTS

2.1 SPLITTER DAMPERS

.1 Of same material as duct but one sheet metal thickness heavier, with appropriate stiffening.

.2 Double thickness construction, airfoil blade profile.

.3 Size and configuration to recommendations of SMACNA.

.4 Control rod with locking device.

.5 Bend end of rod to prevent end from entering duct.

.6 Pivot: piano hinge.

2.2 SINGLE BLADE DAMPERS

.1 Of same material as duct. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA, except maximum height 250 mm (10").

.3 Locking quadrant, with shaft extension to accommodate insulation thickness.

.4 Inside and outside bronze end bearings.

2.3 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

.3 Maximum blade height: 100 mm (4").

.4 Bearings: pin in bronze bushings.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame material of same material as duct, complete with angle stop.

2.4 DIVERTING DAMPERS

.1 Adjustable, curved vanes mounted in supporting frame.

.2 All aluminum construction.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install where indicated on the Drawings and as required to completely balance the air systems.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide all fire dampers and accessories.

1.2 SUBMITTALS

.1 Submit Shop Drawings for each type of fire damper in accordance with Section 21 05 01.

.2 Provide data for inclusion in the Operating and Maintenance Manuals in accordance with Section 21 05 01.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by the manufacturer or those ordered by the manufacturer from an independent testing agency signifying adherence to applicable codes and standards.

PART 2 - PRODUCTS

2.1 FIRE DAMPERS

.1 Fire dampers shall be listed and bear label of ULC and shall meet requirements of Authorities Having Jurisdiction, including but not limited to plans examiner, building inspector, etc.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.3 Top hinged: offset single damper, round or square; multi-blade hinged or interlocking type; roll door type; guillotine type; sized to maintain full duct cross section.

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 Frame and 40 mm x 40 mm x 3 mm (1.5" x 1.5" x 1/8") angle iron on full perimeter of frame on both sides of fire wall and/or fire wall being pierced.

.6 All fire dampers shall be type ‘B’ fire dampers to maintain full duct cross sectional area when open.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install fire dampers in accordance with NFPA 90A.

.2 Maintain integrity of fire wall and/or fire separation.

.3 After completion and prior to concealment, obtain approvals of complete installation from the Consultant and Authorities Having Jurisdiction, including but not limited to plans examiner, building inspector, etc.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide all flexible ductwork.

1.2 REFERENCE STANDARDS

.1 Comply with the requirements of:

.1 ULC S110M for fire tests for air ducts.

.2 UL 181 for factory made air ducts and connectors.

.3 NFPA 90A for installation of air conditioning and ventilating systems.

.4 NFPA 90B for installation of warm air heating and air conditioning systems.

.5 SMACNA for flexible duct installation and duct support standards.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published data ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to applicable codes and standards.

1.4 SAMPLES

.1 Submit samples with Product data of each different type of flexible duct being used.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Factory fabricated.

.2 Pressure drop coefficients listed below are based on sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC - UNINSULATED

.1 Spiral wound flexible aluminum.

.2 Performance:

.1 Minimum working pressure: 2.5 kPa (10" WG)

.2 Maximum pressure drop coefficient : 3.

2.3 METALLIC - INSULATED

.1 Spiral wound flexible aluminum with factory applied flexible glass fibre thermal insulation with vapour barrier and vinyl jacket.

.2 Performance:

.1 Minimum working pressure: 2.5 kPa (10" WG).

.2 Maximum pressure drop coefficient : 3.

.3 Thermal loss/gain: 22 W/sq.m degree C (4 BTU/hr./sq.ft degree F).

2.4 METALLIC – ACOUSTIC FLEX

.1 Spiral wound perforated flexible aluminum with factory applied flexible glass fibre insulation and flame retardant non-toxic polyethylene vapour barrier.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

.1 Provide acoustic metallic flexible duct in all areas unless otherwise indicated on the Drawings.

.2 Provide minimum three (3) screws or stainless steel worm drive clamps to fasten flexible ducts to diffusers or rigid ductwork. Completely seal connections with tape.

.3 Attach flexible ductwork to fan coil unit supply air ductwork with pressure clamps. Fastening with tie-wraps is not acceptable.

.4 Support in accordance with SMACNA.

.5 Maximum length of flexible duct: 1.9 m (6 ft).

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 Provide all grilles, registers, diffusers and accessories.

.2 Grilles, registers and diffusers shall be the product of one manufacturer.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit Shop Drawings in accordance with Section 21 05 01.

1.3 SAMPLES

.1 Samples are required for each type of grille, register and diffuser.

1.4 CERTIFICATION OF RATINGS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by the manufacturer from independent testing agency indicating adherence to ASHRAE and SMACNA codes and standards.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Provide standard product to meet capacity, throw, noise level, throat and outlet velocity.

.2 Where grilles, registers and diffusers penetrate fire walls and fire partitions, provide approved steel sleeve secured to structure in accordance with NFPA 90A.

.3 Frames:

.1 Steel: prime coated cold rolled steel with exposed welded joints and mitred corners.

.2 Aluminum: extruded satin finish with mechanical fasteners and mitred corners.

.3 Provide full perimeter gaskets.

.4 Provide plaster frames as plaster stops where set into plaster or gypsum board.

.5 Provide concealed fasteners and operators.

.4 Sizes and capacities as indicated in Schedules provided on the Drawings.

.5 Floor grilles to be capable of supporting 90 kg (200 lbs) point load weight between supports with negligible deflection.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install with flat head cadmium plated screws in countersunk holes where fastenings are visible.

END OF SECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 This document outlines the minimum equipment and performance standards for a completely interoperable Building Automation System (BAS).

.2 The work shall include design, supply, installation, and commissioning a complete microprocessor based automatic control system to achieve the performance specified in the following Sections.

.3 The BAS shall be supplied and installed by a controls vendor familiar with the system installed at base building by Delta Controls.

.4 The BAS shall be capable of total integration of facility infrastructure systems with user access to all system data, either locally over a secure Intranet within the building or by remote access by a standard Web Browser over the Internet.

.3 The entire BAS shall be peer-to-peer networked, stand-alone, distributed control in accordance with American National Standards Institute/American Society of Heating, Refrigerating and Air Conditioning Engineers (ANSI/ASHRAE) Standard 135-2004, BACnet – A Data Communication Protocol for Building Automation and Control Networks.

.4 All labour, material, equipment and software not specifically referred to herein or on the plans, but is required to meet the functional intent, shall be provided without additional cost to the Owner.

.5 The Contractor shall ensure that the BAS Subcontractor will provide the necessary engineering, installation, supervision, commissioning and programming for a complete and fully operational system. The Contractor will provide as many trips to the job site for installation, supervision, and commissioning as are necessary to complete the project to the satisfaction of the Consultant and/or project supervisor.

The Contractor shall ensure that the BAS Subcontractor will specifically read all mechanical and electrical Drawings, specifications, and addenda and determine the controls work provided by other forces under the Contract, including the mechanical Subcontractor, and the electrical Subcontractor. The Contractor shall ensure the controls Subcontractor has the expertise to coordinate the work of other Subcontractors (electrical, mechanical, general trades, etc.) and to make a completely coordinated Building Automation Control System (BAS) for the mechanical systems.

.6 The BAS shall be compatible with future control Products for 10 years or more.

.7 Ensure compliance with all applicable codes and requirements of Authorities Having Jurisdiction, including but not limited to plans examiner, building inspector, etc.

.8 Ensure the system shall be installed by trade certified electricians regularly employed by the BAS Subcontractor. The system shall be tested and calibrated by factory certified technicians qualified for this type of work and in the regular employment of the BAS Subcontractor or its exclusive factory authorized installing contracting field office representative. The installing office shall have a minimum of five years of installation experience with the manufacturer. Ensure supervision, calibration and commissioning of the system shall be by the BAS Subcontractor.

.9 Refer to the instructions to bidders for the bidders' meeting scheduled prior to the tender closing date to become familiar with field conditions and existing equipment.

1.2 SCOPE

.1 Preparation of control Shop Drawings for review and approval. See Section 1.3 Submittals.

.2 Supply and install a network of Building Automation Control System (BAS) panels and field devices.

.3 Supply and install customized graphics software as specified.

.4 Install, wire and label all BAS control system components.

.5 Calibrate and commission the installed control system.

.6 Provide maintenance manuals and as-built drawings.

.7 Provide customized training for operations, maintenance and technical staff.

.8 Provide complete point-to-point commissioning testing, and submit commissioning report to Commissioning Agent and Consultant prior to Commissioning Functional Testing.

.9 Provide complete updating of existing graphical user interface to indicate all new control point and equipment locations. Graphical interface shall include floor plans with actual locations of wallfin radiators, control valves, temperature sensors, fan coil units, etc.

3.2 SUBMITTALS

.1 Submit Shop Drawings in accordance with Section 21 05 01 and include the following:

- Control Schematics.
- Detailed sequence of operation for each control schematic or controlled system.
- System Architecture indicating the proposed interconnection and location of all BAS
- panels, network connections and key peripheral devices (workstations, modems, printers, repeaters, etc.)
- BAS Points List indicating the panel Identification (ID), panel location, hardware address, point
- acronym, point description, field device type, point type (i.e., AO/DO/AI/DI), end device fail position, end device manufacture and model number, and wire tag ID). Terminal
- identification for all control wiring shall be shown on the shop drawings.
- Wiring diagrams including complete power system, interlocks, control and data
- communications.
- Hard copy graphical depiction of the application control programs.
- Manufacturers' data / specification sheets for all material supplied.

.2 Provide data for inclusion in the Operating and Maintenance Manuals in accordance with Section 21 05 01.

3.3 TRAINING

.1 Training and technical support shall be provided to the Owner's designated representative which will

cover the complete operation of the Building Control System ("BCS") and the software procedures to allow the user to add, modify or create points, Direct Digital Control ("DDC") loops or energy management programmes.

.2 The duration of the training and technical support period shall be not less than eight (8) hours, conducted during normal working hours (i.e. 8.00 a.m. to 4.30 p.m., Monday through Friday). The instruction shall consist of both hands-on and classroom training.

3.4 MANUFACTURER CERTIFICATION

.1 Provide manufacturer certification of the installation in accordance with Section 21 05 01

PART 2 - PRODUCTS

2.1 AUTOMATIC CONTROL VALVES AND OPERATORS

.1 All characteristics of control valves shall be suitable for the required operation.

.2 Straight through water valves shall be single seated with equal percentage flow characteristics.

.3 Three-way mixing valves shall be linear for each port giving constant total flow.

.4 All valves shall have stainless steel stems and spring loaded teflon cone packing.

.5 Valves 50 mm (2") and smaller shall have screwed bodies. Valves 65 mm (2-1/2") and larger shall have flanged cast iron bodies.

.6 The maximum pressure drop across any control valves shall not exceed 21 kPa (3 psi) unless specified otherwise in the Contract Documents.

.7 Valve to have the following characteristics based on application:

Application	Valve Type (≤2")	Valve Type (2"+)	Spring Return	Control Signal
Fan Coil Unit (FCU) Cooling Coil	Globe or Characterized ball	Globe	No	Modulation
Radiator Heating Valve	Globe or Characterized ball	Globe	Yes	Modulation

2.2 THERMOWELLS

.1 Thermowells shall be installed under section 23 05 10. Coordinate the requirements of this Section fully with section 23 05 10 and provide all required locations of thermowells for installation. The Contractor shall be responsible for all costs associated with providing thermowells due to information not being provided in advance of piping installation.

2.3 FIELD SENSORS AND CONTROL DEVICES

.1 Each control unit shall be directly connected to point devices as specified by the input/output summary and control drawings.

.2 Temperature Sensors

.1 All mixed air sensors shall be thermistor type with a 25 ft. averaging element. Accuracy of the thermistor shall be +/- 0.2°C over a range of 0 to 100°C. Sensor utilizing discreet sensor distribution over the length are not acceptable.

.2 All supply and return air sensors shall be thermistor type with nominal value of 10kOhm @ 25 degrees C. The sensor probe shall have a minimum length of 8". The accuracy of the sensor shall be +/- 0.2°C over a range of 0 to 100°C.

Temperature sensors utilized for wall mounting in occupied spaces will be mounted in a white plastic enclosure. The size of the enclosure will not exceed 127 mm Width x 83 mm Height x 25 mm Diameter. The sensor will have a set-point and override push button. The sensor will have a service port to connect a laptop computer. The range shall be 4 to 37°C.

.3 All liquid immersed sensors shall be thermistor type with nominal value of 10kOhm @ 25C. Strap-on temperature sensors are not acceptable. Each sensor shall be provided with a well suitable for the working temperature and pressure of the fluid. The accuracy of the sensor shall be +/- 0.2°C over a range of 20 to 80°C, 0 to 100°C or 50 to 150°C to suit application. Provide brass wells for copper pipe and stainless-steel wells for steel pipe.

.4 Outdoor air sensors shall be the thermistor type with nominal value of 10kOhm @ 25C mounted in a weatherproof enclosure. The accuracy of the sensor shall be +/- 0.2°C over a range of -40 to 60°C.

.3 Room Multi-Sensor Hub

1. The Sensor hub shall measure space temperature at the occupant location and height within the room. Alternatively, provide multiple pendant mounted temperature sensors in each room in addition to the wall-mounted temperature sensors shown. The sensor array shall measure or sense:

   a. The average space temperature at 5’ above the finished floor in an area 10’ in diameter
   b. Relative humidity in the room
   c. Dry bulb temperature in the air surrounding the Sensor Hub
   d. Motion in the space using passive infrared sensing
   e. Sound levels in room
   f. Lighting intensity

2. Based on measured and sensed conditions, the Sensor Hub will provide the following:
   a. Aggregate value for space temperature based on analytics and fusion of multiple sensors to within +/- 0.5 C accuracy
   b. Aggregate values for room occupancy based on analytics and fusion of multiple sensors
   c. Light intensity in foot-candles or lux
   d. Light color in Red, Green, Blue (RGB) values or in degrees Kelvin (color temperature)

3. The sensor hub shall include an EnOcean or Equivalent access point in rooms as per the Drawings

4. The audio information shall not be recorded or stored in any way.

2.4 PANELS

.1 Control panels shall be sprinkler resistant cabinets with all steel construction. Cabinets shall have hinged door with lock. All cabinet locks shall be common keyed.

.2 Panels shall be wall mounted and shall be located in mechanical and electrical rooms.

.3 Locate all control components except control units within control panels.

.4 Each enclosure housing electronic equipment shall have a standard duplex AC power receptacle located within the enclosure to provide power for test equipment.

.1 All wiring internal to panel shall be in conduit or other plastic raceway.

.2 All field wiring shall terminate at a terminal strip. Wiring from terminal strip to controller shall be numbered and colour coded.

2.5 SYSTEM ARCHITECTURE AND COMMUNICATIONS

.1 The BCS shall consist of intelligent microprocessor based control units interconnected by local area networks.

.2 The system shall include three types of control units:

.1 Network control unit.

.2 System control unit.

.3 Terminal control unit.

.4 Integrated Room control unit

.3 Systems utilizing control units incorporating functionality of more than one type are acceptable provided that all capabilities and flexibility specified in the Contract Documents are maintained.

.4 Interface with and connect all new graphics, monitoring and control functions to the existing personal computer (PC) system central supervisory workstations.

.5 Each Network, System, and Integrated Room control unit shall communicate by BACnet ethernet and/or BACnet IP protocols via ethernet port(s)

.6 Each Network, System, and Terminal control units shall have capability to communicate by BACnet MS/TP via a RS-485 port

.7 Operator interface to the system shall be through the PC workstations and each network control unit. All of these locations shall provide access to the complete system.

2.6 CONTROL UNITS - GENERAL

.1 Each control unit shall be capable of full operation either as a completely independent unit or as part of the building-wide control system. All units shall contain the necessary equipment for direct interface to the sensors and actuators connected to it. Provide the necessary quantity of control units to accomplish the requirements of this Specification.

.2 Controllers shall be loaded to a maximum of 90%. 10% of inputs and outputs shall remain unused for

future expansion.

.3 Each control unit shall include its own microprocessor controller, power supply, input/output modules, termination modules and real time clock/calendar.

.4 Each control unit shall be capable of direct interface to a variety of industry standard sensors and input devices.

.1 It shall be possible for each control unit to monitor the following types of inputs:

.1 Analog Inputs (AI)

.1 4 - 20 mA

.2 Thermistors

.3 0 - 10 VDC

.2 Digital Inputs (DI)

.2 The control unit shall directly control electronic actuators and control devices. Each control unit shall be capable of providing the following control outputs:

.1 Digital Output (DO),.

.2 Analog Outputs (AO)

.1 0 - 10 VDC

.3 Each digital output shall have an associated LED mounted within the control unit enclosure to indicate whether the DO relay is in the energized or de-energized position.

.5 Any point connected to the control unit shall be assignable to any energy management programme in a networked system.

.6 It shall be possible to fully create, modify or remove control algorithms within a specific control unit while it is operating and performing other control functions.

.7 The control unit shall contain all software necessary to maintain control of and monitor all points physically connected to it.

.8 Operating System

.1 A real time operating system shall be provided which shall include software to operate, manage and communicate to all peripheral devices.

.2 Upon restoration of power, the operating system software shall ensure that the control unit resumes full operation without operator intervention. The control unit shall automatically reset its clock such that the proper operation of any time dependent function will occur without manual reset. All monitored functions shall be updated.

.3 Should a loss of power exceed battery back-up, the operating system software shall be able to restore the most current versions of all energy management control programmes, direct digital control programmes, data base parameters, and all other data and programmes stored in the RAM of each control unit by downloading from the central computer system.

.4 The operating system shall include self diagnostic software that shall continuously monitor the operation of the control unit. A control unit that is malfunctioning shall annunciate throughout the system indicating the nature of the malfunction and the control unit affected.

.5 Point Database

.1 The control unit software shall have the capability to define each point in the point database and be capable of providing on-line access to the point data base, and on-line editing of the point data base while the system is functioning.

.2 Each point shall have an alphanumeric acronym assigned to it by which it may be referenced for use in any software module or applications programme in the system.

.3 The user editing capabilities of the point database shall be totally accomplished from any operator communication device.

.4 The operator, without assist from the BAS Subcontractor shall be able to add, delete and modify all points within the point database.

.6 Direct Digital Control (DDC) Software

.1 The control unit shall contain DDC software that can be assigned to every analog or digital output point.

.2 The DDC software shall have the capability to be linked to any event or energy management programmes.

.3 The DDC software shall contain all the control functions required to perform the specified sequence of operation, including but not limited to the following:

.1 Proportional, integral and derivative control.

.2 On-Off dead band or floating control.

.3 Sequencing and cascading.

.4 Interlocks.

.5 Calculations.

.6 Boolean Algebra statements.

.7 Time delays.

.4 All DDC functions shall be written in an English language format using a BASIC type software language.

.5 The building operator shall have the capability of adjusting any DDC parameters while the control unit is online.

.9 All controllers shall be capable of operation in any environment that ranges from 32□F to 122□F, with 0% to 90% Relative Humidity ("RH"). The controllers should meet industry standards UL-864 and IEEE-472, if application requires as such as determined by the Consultant.

.10 Input/Output Support

.1 Digital to analog and analog to digital conversion precision within the controller shall provide a minimum of 10 bits accuracy.

2.7 NETWORK CONTROL UNITS

.1 Provide network control units in each mechanical room and as necessary to provide a complete communications system.

.2 The Network control unit shall have a BACnet Ethernet and BACnet IP communication port for communication with Controllers and Operator Workstations at 10 Mbauds, minimum. The Ethernet port must conform to ISO 8802.3. Communication media shall be 10BaseT. Each Controller shall have diagnostic LEDs for the Ethernet communication port. Each Controller shall be addressable via "DIP SWITCH".

.3 The Network control shall support two MS/TP (RS485) BACnet communication ports for communication with terminal control units. These networks shall operate at 76800 bauds. The network speed shall be adjustable from 9600 to 76800 bauds. Each Controller shall have diagnostic LEDs for the MS/TP (RS485) communication port.

.4 The network control unit shall support up to 99 terminal control units.

.5 Network control unit shall permit up to 255 points to be shared between control units.

.6 Provide preprogrammed energy management software that requires only operator configuration for the following:

.1 Time of day scheduling complete with holidays.

.2 Duty cycling with temperature compensation.

.3 Start/Stop optimization.

.4 Electrical demand limiting.

.7 Provide rechargeable battery backup or super capacitor to maintain program entries, clock and all stored data for minimum seventy-two (72) hours. On restoration of power, Network Control Units shall load its program from built-in flash drive, if battery/capacitor backup has failed.

.8 The controller shall be BTL listed.

.9 Operator/System Communication

.1 Each control unit shall contain all software necessary for operator/system communication. This software shall permit full operator communication including as a minimum:

.1 Obtaining information about the performance of the system.

.2 Allowing the operator to add, modify or delete point data or programs.

.3 Diagnosing system malfunctions.

.4 Execution of Report Software as defined in this Specification.

.5 Execution of Alarm and Monitoring Software as defined in this Specification.

.6 Execution of User Programming Software, Energy Management and Direct Digital Control Software as defined in this Specification.

.2 Provide five-level password protection:

.1 Level One: Data Access and Display

.2 Level Two: Level One plus Operator Overrides

.3 Level Three: Level Two plus Database Modification

.4 Level Four: Level Three plus Database Generation

.5 Level Five: Level Four plus Password Add/Modification

.3 It shall be possible for passwords to be defined by the system manager while the system is on-line and fully operational.

.4 All operator communication shall be by full English language commands and prompts.

.10 Monitoring and Control

.1 The operator shall be able to obtain information on all the system functions including point status or value, runtimes, setpoints, energy management parameters, and database elements. All information displayed shall use full English words and numerical values in floating point notation.

.2 Upon selection of any command point, the operator may change the point's binary state (START/STOP/AUTO) by actuating a single dedicated function key on the keyboard. Failure of the command to execute, as detected by a proof of operation status input, shall result in an alarm condition providing that no higher priority control action is in progress superseding the manual command. All manual, program or event commands competing for control of a start/stop binary point shall be prioritized with the highest level taking control until released to the next lower command state. Provide sixteen (16) priority levels which may be displayed with their current status for each logical two (2) or three (3) state command point in the system. Setpoints for analog control points and Proportional, Integral, Derivative (“PID”) loops shall be changed by selecting the point (and its setpoint entry element) and typing in its new setpoint value for manual setpoint control.

.3 All start/stop and status points shall accumulate runtime.

.11 Report Software

.1 Provide software to produce reports in pre-defined format. All of the reports and logs specified in this Section shall be provided in a "ready to use" state. Documentation for operator use of these reports shall include specific examples of how to institute and interpret the reports.

.2 The functional operation of the control unit shall not be affected by report display or printing.

.3 All reports and logs shall include the date and time of report initiation, the name of the report, and row and column headings with all units clearly labelled.

.4 All reports and logs shall be attainable on a per point basis or on a user defined group of points. Groups of points shall be logically combined without regard to the hardware physical location.

.5 As a minimum, the following control unit report summaries shall be provided:

.1 All point summary.

.2 Group summary.

.3 Status summary.

.4 Alarm summary.

.5 Analog alarm limit summary.

.6 Locked out points summary.

.7 Message summary.

.8 DC programme listing.

.9 Historical trend report.

.10 Totalization report.

2.8 SYSTEM CONTROL UNITS

.1 Provide standalone system control units as required to implement the specified control functions. Provide one system control unit for each supply air system and each water system.

.2 All input/output points associated with a physical system shall be directly connected to the system control unit. Provide control units with input/output configurations to meet specific application requirements.

.3 System control units shall be fully user programmable via the associated network control unit.

.4 The system control unit shall have a BACnet Ethernet and BACnet IP communication port for communication with Controllers and Operator Workstations at 10 Mbauds. The Ethernet port must conform to ISO 8802.3. Communication media shall be 10BaseT. Each Controller shall have diagnostic LEDs for the Ethernet communication port. Each Controller shall be addressable via “DIP SWITCH”.

.5 Each System control unit shall include an integral real time clock/calendar.

.6 Provide rechargeable battery backup or super capacitor to maintain program entries, clock and all stored data for minimum seventy-two (72) hours. On restoration of power, System control units shall load its program from built-in flash drive, if battery/capacitor backup has failed.

.7 Provide the following software capabilities for each system control unit:

.1 Proportional, Integral, Derivative (PID) control.

.2 Temperature compensated duty cycling.

.3 Self-diagnostics.

.4 Start/Stop optimization.

.5 Programmable logic control.

.6 Enthalpy control.

.7 Time of day scheduling.

.8 Power failure restart.

.9 User defined programming.

.8 Provide lockable metal enclosure suitable for wall mounting or locate within control panels.

.9 Controller shall support the use of a user friendly handheld or panel mounted interface unit. This unit will display a graphic of the system being controlled, store alarms, and have audible/visual alarm indicator. Provide display unit as noted on points listed.

.10 The controller shall be BTL listed.

2.9 TERMINAL CONTROL UNITS

.1 Provide standalone application specific control units for all terminal units where indicated in the Contract Documents.

.2 Terminal control units shall include preprogrammed control sequences requiring only configuration or be fully programmable based on application. The database shall be maintained in non-volatile Flash drive memory.

.3 Provide the following software capabilities for each terminal control unit:

.1 PID space temperature control.

.2 Self-diagnostics.

.3 Power failure restart.

.4 Provide outputs for damper operator, control valves and fan control as required for each application. Where necessary, provide control relays to interface between control units and fan circuit.

.5 Provide local communication jack at controller.

.6 The terminal control shall support a MS/TP (RS485) communication port. These networks shall operate at 76800 bauds. The network speed shall be adjustable from 9600 to 76800 bauds. Each controller shall have diagnostic LEDs for the MS/TP (RS485) communication port.

.7 Provide rechargeable battery backup or super capacitor to maintain program entries, clock and all

stored data for minimum seventy-two (72) hours. On restoration of power, System control units shall load its program from built-in flash drive, if battery/capacitor backup has failed.

.8 The controller shall be BTL listed.

2.10 INTEGRATED ROOM CONTROL UNITS

.1 Provide standalone programmable control units as required to implement the specified control functions.

.2 All input/output points associated with a physical system shall be directly connected to the programmable control unit. Provide control units with input/output configurations to meet specific application requirements.

.3 Programmable control units shall be fully user programmable via the associated network control unit.

.4 The controller shall be a Deutsche Institut für Normung (DIN) rail mounted, BTL listed BACnet Rev 14 or greater Advanced Application Controller.

.5 The controller must have dual port Ethernet that allows 'daisy chained' network connectivity.

.6 The controller shall be expandable to include the modules that are needed for the automation of the space.

.7 Controller universal I/O shall be fully software configured and defined as either input or output, and shall support input types of 10K, 0-5V, 0-10V, or 4-20mA, and outputs of 0-10V sourcing or 1-10V sinking current modes, so as to include support for control of dimmable lighting ballasts.

.8 Each programmable control unit shall include an integral real time clock/calendar.

.9 Provide rechargeable battery backup or super capacitor to maintain program entries, clock and all stored data for minimum seventy-two (72) hours. On restoration of power, System control units shall load its program from built-in flash drive, if battery/capacitor backup has failed.

.10 Provide the following software capabilities for each programmable control unit:

.1 PID control.

.2 Temperature compensated duty cycling.

.3 Self-diagnostics.

.4 Start/Stop optimization.

.5 Programmable logic control.

.6 Enthalpy control.

.7 Time of day scheduling.

.8 Power failure restart.

.9 User defined programming.

.11 Provide lockable metal enclosure suitable for wall mounting or locate within control panels.

.12 Controller shall support the use of a user friendly handheld or panel mounted interface unit. This unit will display a graphic of the system being controlled, store alarms, and have audible/visual alarm indicator. Provide display unit as noted on points listed.

2.11 CENTRAL COMPUTER SYSTEM HARDWARE

.1 Terminal unit controllers shall support the use of a user friendly handheld or panel mounted interface unit. This unit shall directly connect to the controller through the room sensor jack, or directly at the controllers communications jack. Provide one handheld display and instruct building maintenance on use.

PART 3 - EXECUTION

3.1 POWER AND CONTROL WIRING

.1 Provide all necessary conduit, fittings and wire to provide a complete control system described in this Specification. Power and Control wiring shall be installed in EMT conduit. Plenum cable is not acceptable.

.2 Provide power to control panels from the nearest electrical panel. Power for control system shall **not** be obtained by tapping into miscellaneous circuits that could be inadvertently switched off. Only dedicated circuit(s) shall power the control system. Provide additional breakers or electrical panels as required.

3.2 IDENTIFICATION

.1 Provide engraved lamacoid nameplate clearly indicating the service and designation for the following devices. The nameplate for any device being controlled by the Energy Management Control System ("EMCS") shall also include the EMCS point name and the designation of the control panel which serves the device.

.1 Duct and pipe mounted sensors.

.2 Electronic control panels.

.3 Manual switches.

.4 Thermostats in unfinished areas.

.5 Control valves.

.6 Damper operators.

.2 All wiring shall be identified with permanent numbered wire markers cross referenced to wiring diagrams.

3.3 CONTROL UNITS

.1 Locate control units to be accessible for service and replacement.

.2 Provide power from nearest electrical panel. Provide all transformers necessary to power control units, actuators and other system components.

.3 Network Control Units

.4 Locate network control units within spaces shown on the Drawings. Confirm exact location with Consultant.

.5 Mount units with operator interface at level convenient for viewing and operation.

.6 Programmable Control Units

.7 Locate programmable control units adjacent to equipment served.

.8 Programmable control units shall not be mounted on mechanical or electrical equipment.

.9 The Contractor shall co-ordinate with heat pump manufacturer and provide commissioning.

3.4 PROGRAMMING

.1 Provide all programming necessary for a fully functioning system.

.2 The control strategy for each system shall be performed by software within the control unit. Refer to the Control Drawings for the sequence of operation for each system.

.3 Tune each temperature control loop to provide control within ±1^{o}F unless otherwise indicated in the Contract Documents.

.4 Provide time schedules for all start/stop points.

.5 Provide high and low limit alarms on all analog input points.

.6 Program the level of annunciation for each alarm to the requirements of the Owner

.1 Local to specific network control unit(s).

.2 PC Workstations.

3.5 DEMONSTRATION AND TESTING

.1 Submit a schedule of testing for each system, sample checklist and description of tests for review by the Consultant.

.2 Provide detailed testing of each system prior to review by the Consultant. Submit a checklist, by system, indicating that all connected points and programming have been verified as specified herein.

.3 The BCS will not be considered substantially complete until all specified points are connected to the

system and testing has been completed.

.4 All digital input alarm points (eg. high level, low pressure, etc.) shall be tested by physically simulating an alarm condition.

.5 Start/stop points shall be verified by physical inspection.

.6 All temperature, humidity and pressure sensors shall be calibrated using accurate electronic testing equipment as a reference.

.7 All control loops and programmed sequences of operation shall be verified by simulating conditions for each mode of operation.

.8 Provide demonstration of each system to the Consultant and the Owner when testing is completed. The purpose of this demonstration is to verify that testing has been successfully completed.

3.6 OWNER'S INSTRUCTION

.1 Provide instruction to the Owner's representatives with respect to operation and maintenance of the BCS. This is not part of training as specified below.

.2 Explain the operation of each device including normal operating conditions, emergency procedures and maintenance requirements.

.3 Indicate, by physical inspection, the location of all control devices within mechanical and other service rooms.

.4 Demonstrate procedures for adjusting and calibrating thermostats, controllers and sensors. Demonstrate all manual override capabilities of the system.

3.7 POINT-TO-POINT COMMISSIONING

.1 Provide complete point-to-point commissioning testing, and submit commissioning report to Commissioning Agent and Consultant prior to Commissioning Functional Testing.

END OF SECTION

PART 1 – GENERAL

1.1 General

.1 The purpose of this section is to specify Division 25 responsibilities in the commissioning process for the work of Division 23.

.2 The systems to be commissioned are listed in Section 01 91 00 subsection 1.9. The abbreviations and definitions used in Section 01 91 00 apply to this Section 23 08 00 – HVAC System Commissioning.

.3 Commissioning shall take into account the requirements under Division 25 to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 01 91 00. For the purposes of completing work under Division 25 shall be familiar with all parts of Section 01 91 00 and the commissioning plan issued by the CA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.2 Responsibilities

.1 Controls Subcontractor. The responsibilities of the Contractor and its Controls Subcontractor, during construction and acceptance phases in addition to those listed above are (all references apply to commissioned equipment only):

.1 Sequences of Operation Submittals. The Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. They shall include:

.1 An overview narrative of the system (1 or 2 paragraphs) generally describing its purpose, components and function.

.2 All interactions and interlocks with other systems.

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

.4 Written sequences of control for packaged controlled equipment. (Equipment manufacturers' stock sequences may be included but will generally require additional narrative).

.5 Start-up sequences.

.6 Warm-up mode sequences.

.7 Normal operating mode sequences.

.8 Unoccupied mode sequences.

.9 Shutdown sequences.

.10 Capacity control sequences and equipment staging.

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

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

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

.14 Sequences for all alarms and emergency shut downs.

.15 Seasonal operational differences and recommendations.

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

.17 Schedules, if known.

.18 To Facilitate referencing in testing procedures, all sequences shall be written in concise statements.

.2 Control Drawings Submittal

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

.2 The control drawings shall contain graphic schematic depictions of the systems and each component (i.e. sensors, dampers, coils, valves, etc.)

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

.4 Provide a full points list with at least the following included for each point:

.1 Controlled system

.2 Point abbreviation

.3 Point description

.4 Display unit

.5 Control point or setpoint (Yes / No)

.6 Monitoring point (Yes / No)

.7 Intermediate point (Yes / No)

.8 Calculated point (Yes / No)

.9 Key:

Point Description: DB temp, airflow, etc.

Control or Setpoint: Point that controls equipment and can have its setpoint changed (OSA, SAT, etc.)

Intermediate Point: Point whose value is used to make a calculation which then controls equipment (space temperatures that are averaged to a virtual point to control reset).

Monitoring Point: Point that does not control or contribute to the control of equipment, but is used for operation, maintenance, or performance verification.

Calculated Point: “Virtual” point generated from calculations of other point values.

The Controls Contractor shall keep the CA informed of all changes to this list during programming and setup.

.3 As-Built Controls Package - An updated as-built version of the Controls Drawings and Sequence of Operation, which is to include all items identified above, shall be provided to the CA and included in the final controls O&M manual submittal.

.4 Assist in TAB Work- Ensure the Controls Subcontractor shall assist in the TAB work through the following:

.1 Meet with the TAB Subcontractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB Subcontractor any needed unique instruments for setting terminal unit boxes and instruct the TAB Contractor in their use (handheld control system interface for use around the building during TAB, etc.).

.2 For a given area, have all required prefunctional checklists, calibrations, startup and selected functional tests of the system completed and approved by the CA prior to TAB.

.3 Provide a qualified technician with minimum 5 years of verifiable controls installation and programming experience to operate the controls to assist the TAB contractor in performing TAB, or provide sufficient training for TAB to operate the system without assistance.

.5 Required assistance to the CA - Assist and cooperate with the CA in the following manner:

.1 Using a skilled technician who is familiar with the building, execute the functional testing of the all equipment specified in Section 01 91 00 under direction of the CA. Provide two-way radios during the testing.

.2 Execute all control system trend logs specified in Section 01 91 00.

.3 Written Plan – Ensure the Controls Subcontractor shall prepare a written plan indicating in a step-by-step manner, the procedures that will be followed to test, checkout and adjust the control system prior to functional performance testing, according to the process in Section 01 91 00. At minimum, the plan shall include the following for each type of equipment controlled by the automatic controls:

.1 System name.

.2 List of devices.

.3 Step-by-step procedures for testing each controller after installation, including:

.1 Process of verifying proper hardware and wiring installation.

.2 Process of downloading programs to local controllers and verifying that they are addressed correctly.

.3 Process of performing operational checks of each controlled component.

.4 Plan and process for calibrating valve and damper actuators and all sensors.

.5 A description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.

.4 A copy of the log and field checkout sheets that will document the process. This log must include a place for initial and final read values during calibration of each point and clearly indicate when a sensor or controller has “passed” and is operating within the contract parameters.

.5 A description of the instrumentation required for testing.

.6 Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the CA and TAB Subcontractor for this determination.

.6 Checkout Certification - Provide a signed and dated certification report to the CA and PM/GC upon completion of the checkout of each controlled device, equipment and system prior to functional testing. This report shall serve as confirmation that all system programming is complete in accordance to the Contract Documents, with the exception functional testing requirements. The checkout report shall also include complete point-to-point verification and sequence of operations verification checklists.

.7 List and clearly identify on the as-built duct and piping drawings the locations of all static and differential pressure sensors (air, water and building pressure).

PART 2- PRODUCTS

.1 NOT USED

PART 3- EXECUTION

3.1 Submittals

.1 Provide submittal documentation relative to commissioning to the CA as requested by the CA. Refer to Section 01 91 00 Part 3.3 for additional Section 25 requirements.

3.2 Start-up of Equipment

.1 Follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in Section 01 91 00, Part 3.4. Ensure the start-up responsibility under Division 21 is met has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the CA or Owner.

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

.3 Prior to the start up of equipment under Division 21 the Contractor shall arrange to have the manufacturer of all major equipment inspect the installation to ensure their equipment has been installed in accordance with their recommendations.

.4 The manufacturer shall submit a written report of their findings.

.5 Upon confirmation that the equipment has been installed in accordance with the Manufacturers Recommendations the equipment may be started.

.6 All equipment shall be started by the manufacturer’s representative.

3.3 Pre-Functional Test Sheets

.1 Pre-functional test sheets contain items to be performed under Division 25. On each checklist, a column is provided that is to be completed by the contractor assigning responsibility for that line item to a trade. Those executing the test sheets are only responsible to perform items that apply to the specific application at hand. These test sheets do not take the place of the manufacturer’s recommended checkout and start-up procedures or report. Some checklist procedures may be redundant in relation to checkout procedures that will be documented on typical factory field checkout sheets. Double documenting may be required in those cases.

.2 Refer to Section 01 91 00 for additional requirements regarding pre-functional test sheets, startup and initial checkout. Items that do not apply should be noted along with the reasons on the checklist. If this checklist is not used for documenting, one of similar rigor and clarity shall be used pending approval from the CA. Contractor's assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off. "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = Architect/Engineer, All = Contractor including all Subcontractors, CA = Commissioning Agent, CC = Controls Subcontractor, EC = Electrical Subcontractor, PM/GC = General Contractor, MC = Mechanical Subcontractor, SC = Sheet Metal Subcontractor, TAB = Test and Balance Subcontractor.

3.4 Operations and Maintenance Manuals

.1 Compile and prepare documentation for all equipment and systems covered in Division 25 and deliver to the GC for inclusion in the O&M manuals

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

3.5 Training of Owner Personnel

.1 The GC shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed. Refer to Section 01 91 00 for additional details.

.2 The CA shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment. Refer to Section 01 91 00 for additional details.

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

.1 Provide the CA with a training plan two weeks before the planned training according to the outline described in Section 01 91 00, Part 3.8.

.2 Provide designated Owner personnel with comprehensive training in the understanding of the systems and the operation and maintenance of the BAS system.

.3 Training shall start with classroom sessions, if necessary, followed by hands on training on the BAS, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.

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

.5 The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.

.6 Training shall include:

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

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

.3 Discuss relevant health and safety issues and concerns.

.4 Discuss warranties and guarantees.

.5 Cover common troubleshooting problems and solutions.

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

.7 Discuss any peculiarities of equipment installation or operation.

.8 Classroom sessions shall include the use of overhead projections, slides, video and audio taped material as might be appropriate.

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

.8 Ensure the Controls Subcontractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system.

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

3.6 Deferred Testing

.1 Refer to Section 01 91 00, Part 3.9 for requirements of deferred testing.

3.7 WRITTEN WORK PRODUCTS

.1 Written work products under Division 25 shall consist of the start-up and initial checkout plan as described in Section 01 91 00, as well as completed start-up, initial checkout and pre-functional test sheets.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 03.00 – RECORD DRAWINGS.

1.1.3. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

2. Products

2.1. NOT USED

3. Execution

3.1. REQUIREMENTS FOR MANUALS

3.1.1. A minimum of three copies of complete and approved operating and maintenance instructions for all electrical equipment and systems shall be supplied before Substantial Performance of the Contract. In addition to the three copies of manuals, the Contractor shall provide a manual in a searchable PDF format on CD or DVD or USB stick. As-Built Drawings to be included on the CD or DVD or USB stick.

3.1.2. The Contractor shall identify the cost of Record Drawings and the Operation and Maintenance Manuals as a separate line item on their progress draw. The values to be broken out can be found in Section 26 05 03.00 – Record Drawings. The project will remain incomplete and no money will be released until the final versions, both hard and electronic, of the Drawings and manuals are received and reviewed without comments.

3.1.3. Binders shall be three-ring, hard-cover, loose-leaf type and identified on the binding edges as “Maintenance Instructions and Data Book”, for “Contract No. T-19-349”.

3.1.4. Terminology used in all the sections shall be consistent.

3.1.5. Volume One shall contain the master index of all systems, the name of the Contractor, electrical Subcontractors and the date of Substantial Performance of the Contract.

3.1.6. Volume One shall contain a section with all necessary warranty information.

3.1.7. Each binder shall have a complete index for all volumes.

3.1.8. Each binder shall be no more than half filled.

3.1.9. There shall be a separate section for all materials used on the project which fall under the WHMIS legislation. There shall be an MSDS, hazard data sheet, for each of the materials.

3.1.10. There shall be a separate section for all insurance certificates, test certificates, verification forms and test forms.

3.1.11. All relevant information relating to a system or product shall be contained within one binder.

3.1.12. The manual sections shall follow the Specification sections.

3.1.13. Any diagrams, installation drawings, single line diagrams charts, etc. shall be mechanically reduced while maintaining full legibility to standard page size. If this cannot be achieved, they shall be carefully folded and contained within a clear plastic wallet within the manual.

3.2. DATA FOR MANUALS

3.2.1. Equipment data shall contain:

.1 Operating instructions.

.2 Operating conditions such as temperature and pressure.

.3 Location of equipment.

.4 Maintenance instructions and schedules for one-year routine.

.5 Recommended list of spare parts.

.6 Maintenance schedule.

.7 A trouble shooting table showing where to look for problems under various conditions of malfunction.

.8 All wiring diagrams.

.9 Equipment operating curves.

.10 Equipment nameplate data and serial numbers.

3.2.2. System data shall contain:

.1 A listing of all systems.

.2 All panel, MCC and fire alarm schedules and locations.

.3 Equipment name tags.

.4 Cleaning, maintaining and preserving instructions for all material, Products and surfaces. Include warnings of harmful cleaning, maintaining and preserving practices.

3.2.3. Subcontractor manuals are required for:

.1 Switchboards and power distribution systems.

.2 Lighting systems.

.3 Emergency power systems.

.4 Fire alarm systems.

3.2.4. As-Built documentation shall contain:

.1 Reviewed As-Built Shop Drawings.

.2 As-Built construction Drawings.

.3 Originals of test forms.

.4 Originals of test certificates.

3.3. OPERATING INSTRUCTIONS

3.3.1. Instruct the Region’s representative in all aspects of the operation and maintenance of systems and equipment.

3.3.2. Instruct the Region for a minimum of five (5) Working Days.

3.3.3. All instruction sessions shall be videotaped, and a copy must be provided to the Consultant and/or the Region.

3.3.4. Arrange for and pay for the services of Professional Engineers and other manufacturers’ representatives required for instruction on the systems and the equipment as requested by the Consultant and/or the Region.

3.3.5. At the time of final review, provide a sheet for each system and piece of equipment showing the date instructions were given. Each sheet shall show the duration of instruction, name of persons receiving instruction, other persons present (manufacturer's representative, the Consultant, etc.), system or equipment involved and signature of the Region's staff stating that they understood the system installation, operating and maintenance requirements. This information shall be inserted in the manuals after all instructions have been completed.

3.3.6. Review information with the Region's representative to ensure that all information required has been provided.

3.3.7. Electrical equipment and systems included in the instruction requirements, include but not limited to the following:

.1 Switchboards and related power distribution equipment.

.2 Emergency generator.

.3 Automatic transfer switches.

.4 Fire alarm systems.

3.4. TRIAL USAGE

3.4.1. The Region shall be permitted trial usage of systems or parts of systems for the purpose of testing and learning operational procedures. Trial usage shall not affect the warranties nor be construed as acceptance, and no claim for damage shall be made against the Region for any injury or breakage to any part or parts due to the tests, where such injuries or breakage are caused by a weakness or inadequacy of parts, or by defective materials or workmanship of any kind.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Conform to the requirements of the architectural Sections of the Contract, which applies to and forms part of all sections of the Work.

1.2. DESCRIPTION OF SECTION

1.2.1. This Specification is divided into sections of Work and a section may consist of the Work of more than one Subcontractor. The responsibility as to which electrical Subcontractor provides labour, materials, equipment and services required to complete the Work rests solely with the Contractor.

1.3. SECTIONS AFFECTED

1.3.1. These instructions apply to and form a part of all sections of the electrical Division.

1.4. SCOPE

1.4.1. Provide all labour, materials, equipment and services to complete the Work of the electrical Division as further specified and as shown on the Drawings.

1.4.2. Should any discrepancy appear between any parts of the Specifications and/or the Drawings to cause doubt as to the true meaning and intent of the Drawings and Specifications, a ruling shall be obtained from the Consultant before submitting the tender. If this is not done the following will be assumed:

.1 Where a discrepancy occurs in the Drawings, the more expensive/onerous alternative will be deemed as included in the Contract.

.2 Where a discrepancy occurs in the Specifications, the more expensive/onerous alternative will be deemed as included in the Contract.

1.5. REGULATIONS

1.5.1. All Work shall be performed in accordance with the latest codes, rules, regulations, by-laws and requirements of the Electrical Safety Authority, Newmarket Building Department, and Fire Warden except where the requirements of the Drawings and Specifications exceed the codes, rules, regulations, by-laws and requirements of the Electrical Safety Authority, Newmarket Building Department, and Fire Warden.

1.5.2. These Specifications are supplementary to the requirements above.

1.5.3. The Drawings and Specifications should not conflict with the above regulations but, where there are apparent discrepancies, the Contractor shall notify the Consultant.

1.6. PERMITS, FEES, AND REVIEWS

1.6.1. Make submissions to obtain all permits. Include for and pay for all fees and arrange for all reviews required for the Work of this Division.

1.6.2. Ensure that, if required by Ontario Electrical Safety Code, and/or Ontario Building Code, Drawings and Specifications have been previously submitted to the Newmarket Building Department.

1.6.3. Furnish certificates of acceptance from the Newmarket Building Department and include them in the operation and maintenance manual.

1.7. VOLTAGE RATINGS

1.7.1. Operating voltages are as specified in CAN3-C235-(latest edition).

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

1.8. COORDINATION WITH MECHANICAL DIVISIONS.

1.8.1. Unless indicated otherwise on the electrical Drawings, the Contractor shall ensure that the electrical Subcontractor supplies and installs the following:

.1 Starters.

.2 Line and load side wiring for starters.

.3 Reduced voltage starters including “Soft Start” starters.

.4 Line and load side wiring to variable speed drives, including but not limited to wiring of associated harmonic filters, AC line input reactors, dV/dT filters, and output filters.

.5 Provisions of disconnects to all mechanical equipment.

.6 All power wiring (120V and above) to all mechanical equipment.

.7 Electrical ramp heating cables and controls.

.8 All motorized damper power connections (120V and above).

.9 Fire alarm devices.

.10 Wiring to electric space heaters.

1.8.2. Mechanical Divisions will be responsible for the supply and installation of the following:

.1 All variable speed drives and control wiring to starters.

.2 Pipe tracing and related controls.

.3 Electric hot water heaters.

.4 All electrical heaters including baseboard heaters, cabinet heaters, force flow heaters and radiant heaters.

.5 All interposing relays, relays, contactors and 120V control devices.

.6 All 120V and low voltage control wiring and conduits.

1.8.3. Determine exact location of starters, motors and line voltage controls based on the mechanical Drawings to coordinate with the locations of all equipment to ensure the required clearances are maintained. If no wall location is suitable for the motor starters, then mount the starters on a plywood backboard on strut channel supports (Unistrut or Equivalent) near the respective equipment to meet the applicable code requirements for motor isolation switches. If a motor or piece of equipment is listed on one of the starter schedules but is not shown on the Drawings, the Contractor shall reference the mechanical Drawings for the location of the respective piece of equipment. No additional costs will be entertained.

1.8.4. Should the Contractor change any of the motor or equipment sizes from those identified on the mechanical schedules and Drawings at any stage of the project to aide their installation, the Contractor will incur all additional electrical costs to revise the electrical feeders, breakers, starters and equipment to supply power to the revised piece of equipment.

1.9. PLYWOOD BACKBOARDS, EQUIPMENT MOUNTING AND HOUSEKEEPING PADS

1.9.1. Provide fire rated plywood backboards as shown on the Drawings and mount where all communication equipment is to be wall mounted. Plywood shall be 21 mm, urea-formaldehyde (UF) free and shall be either, Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI) or CSA Z809-(latest edition) certified. Plywood shall be either fire rated with the appropriate label displayed once installed or coated with fire retardant paint. Do not paint over plywood fire rating certification stamp. All Certification not to be painted.

1.9.2. Surface mounted electrical equipment boxes are to be installed on galvanized strut channel (Unistrut or Equivalent) stand-offs. Electrical equipment boxes shall include, but not be limited to electrical panels, low voltage (LV) lighting control, fire alarm, security, communication, electrical sub-metering, etc. Panels are to be grouped on common base wherever practical.

1.9.3. Provide steel re-enforced concrete housekeeping pads under all floor mounted electrical equipment and where noted on the Drawings. All housekeeping pads shall be a minimum of 100mm high above finished floor and shall not extend beyond 50mm beyond the electrical equipment unless shown otherwise on the Drawings.

1.10. FINISHES

1.10.1. Metal enclosure surfaces shall be finished by the application of rust resistant primer on both the inside and outside, with at least two coats of enamel.

1.10.2. Clean and touch up all surfaces of equipment scratched or marred during shipment or installation. Match the original paint.

1.10.3. Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.10.4. All paints, coatings, sealants and adhesives shall meet the VOC limits in accordance with the applicable standards and regulations. Submit documentation as a Shop Drawing for review prior to ordering.

1.11. SAFETY

1.11.1. Protect exposed live equipment during construction for personnel safety.

1.11.2. Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.

1.11.3. Arrange for the installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of an electrician.

1.12. FIRE STOPS

1.12.1. Provide fire stops in accordance with the Contract Documents, including this Section. The Contractor shall coordinate fire stops with the electrical Subcontractor. All paints, coatings, sealants and adhesives shall meet the VOC limits in accordance with the applicable standards and regulations. Submit documentation as a Shop Drawing for review prior to ordering.

1.12.2. Fire stops and smoke seal systems: in accordance with CAN/ULC-S115 (latest edition).

.1 Asbestos free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN/ULC-S115 (latest edition) and not to exceed opening sizes for which they are intended.

.2 Fire stop system rating for service penetrations: to suit the latest edition of the Ontario Building Code, and meet requirements of the Newmarket Building Department.

.3 Fire stop system rating for sealing junction of rated walls to rated floors and ceilings: to suit Ontario Building Code, and meet requirements of the Newmarket Building Department.

1.12.3. Service penetration assemblies: certified by ULC in accordance with CAN/ULC-S115 (latest edition) and listed in ULC Guide No. 40 U19.

1.12.4. Service penetration fire stop components: certified by ULC in accordance with CAN/ULC-S115 (latest edition) and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.

1.12.5. Fire resistance rating of installed fire stop assembly not less than the fire resistance rating of surrounding floor and wall assembly, and in accordance with the Ontario Building Code, and meet requirements of the Newmarket Building Department.

1.12.6. Fire stops and smoke seals at openings intended for ease of re-entry, such as cables: elastomeric seal; do not use cementitious or rigid seal at such locations.

1.12.7. Fire stops and smoke seals at openings around penetrations for conduits, cable trays, pipes, ductwork and other electrical and mechanical items requiring sound and vibration control: elastomeric seal; do not use a cementitious or rigid seal at such locations.

1.12.8. Primers: to manufacturer's recommendation for specific material, substrate, and end use.

1.12.9. Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

1.12.10. Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to the Newmarket Building Department.

1.12.11. Sealants for vertical joints: non-sagging.

1.12.12. Colour: if range available to the Consultant's choice of standard colours, generally to match background colour where visible in finished spaces.

1.12.13. Through non-fire or non-smoke separations or where waterproof membrane is field applied, where pipes are insulated, sleeves shall be sized to accommodate the insulation and vapour barrier.

1.12.14. Where holes are core drilled in existing structures, sleeves shall be provided as specified complete with fire stopping as noted above.

1.12.15. Submit a complete fire stop system Shop Drawing package, identifying the Products that may be used on the project. Prior to submitting data, review with the Newmarket Building Department to confirm acceptability of proposed materials and assemblies.

1.12.16. Installation

.1 Install fire stops and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.

.2 Seal holes or voids made by through penetrations, poke through termination devices, and un-penetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to a neat finish.

.5 Remove excess compound promptly as Work progresses and upon completion.

1.13. CLEANING AND WASTE REMOVAL

1.13.1. Clean all electrical equipment that has been exposed to construction dust and dirt.

1.13.2. The Contractor shall clean all electrical equipment, inside and out, prior to turn over to the Region. Equipment is subject to review by the Consultant and/or the Region.

1.13.3. The Contractor shall remove its own waste from the Site. All re-usable materials shall be recycled.

1.14. SPRINKLERS

1.14.1. All electrical equipment shall be suitable for installation in a sprinklered environment and enclosures shall be CSA Type-2 sprinkler proof.

1.15. TEMPORARY LIGHT AND POWER

1.15.1. Temporary light and power for construction shall be provided, metered, and maintained by the electrical Subcontractor, as directed by the Contractor; but each trade shall provide all extension cords, lamps, etc., required to complete their Work.

1.15.2. All temporary light shall be fluorescent. Provide adequate lighting to meet all health and safety standards.

1.16. EXAMINATION AND PROTECTION OF SITE

1.16.1. Please refer to Instructions to Bidders from the Region.

1.16.2. The Contractor shall document any existing conditions on Site and submit a pre-condition survey including pictures. The Contractor shall return the Site back to its original form, which includes but is not limited to ground repair including grading and new sod and repair of damaged walls, doors and/or floors.

1.16.3. The Contractor shall protect trees and plants on Site and on adjacent properties. Plants shall be protected with burlap. Trees and roots within construction area shall be protected by the erection of temporary 2m high plywood hoarding at the drip line of the tree. The Contractor shall avoid unnecessary traffic, dumping and storage of materials at or near trees or plants.

1.16.4. When requested by the Region and/or Consultant, the Contractor shall provide digital pictures of the Site, including but not limited to progress of Work and installed equipment, via e-mail to the Region and/or Consultant.

1.17. DRAWINGS AND INSTALLATION

1.17.1. The Drawings are intended to show the general character and scope of the Work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operative installation.

1.17.2. The location, arrangement and connection of equipment and materials shown on the Drawings represent a close approximation to the intent and requirements of the Contract. The right is reserved by the Consultant to make reasonable changes required to accommodate conditions arising during the progress of the Work, at no additional cost to the Region.

1.17.3. Certain details indicated on the Drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details shall be applicable to every occurrence on the Drawings.

1.17.4. The actual location of switches, outlets and luminaries, etc. shall be reviewed by the Consultant before installation.

1.17.5. The location and size of existing services shown on the Drawings are based on the best available information. The actual location of existing services shall be verified in the field before Work is commenced. Particular attention shall be paid to buried services.

1.17.6. Changes and modifications necessary to ensure co-ordination and avoid interference and conflicts with other trades or to accommodate existing conditions, shall be made at no additional cost to the Region.

1.17.7. Leave areas clear where space is indicated as reserved for future equipment, and equipment for other trades.

1.17.8. Adequate space and provisions shall be left for removal of components and servicing of equipment, with minimum inconvenience to the operation of systems.

1.17.9. Where equipment is shown to be ‘roughed-in only’ obtain accurate information from the Consultant before proceeding with the work.

1.17.10. The Contractor shall review the Specifications, Drawings and details to confirm locations of devices and equipment.

1.17.11. This Contractor shall mark-out its Work, fully co-ordinated with all other trades, in sufficient time for review by the Consultant prior to rough-in. Prepare dimensioned layouts of each room prior to rough-in for review by the Consultant. Do not proceed with any Work until the Consultant has reviewed the layout Drawings.

1.17.12. The Contractor will reimburse the Consultant for their time spent on answering any written questions or requests for information where the answer is clearly identified on the Drawings or in the Specifications.

1.18. INSTALLATION, INTERFERENCE AND SETTING DRAWINGS

1.18.1. The Contractor shall complete installation, interference and setting Drawings, dimensioned and to scale for all systems. They shall be made available for review by the Consultant, if requested. The Drawings are required to make clear the Work intended or to show its relation to adjacent Work or to the Work of other trades. When an alternative piece of equipment is to be substituted for equipment shown, Drawings of the area involved shall be prepared by this Division.

1.18.2. Slab layout Drawings shall be submitted for review by the Consultant. These slab layout Drawings shall be included in the as-built drawings. Refer to Section 26 05 03.00 – RECORD DRAWINGS.

1.18.3. Interference Drawings are required for shafts, ceiling spaces, basement areas, typical floors and wherever there is possible conflict in the positioning of electrical equipment, piping, ductwork sub-trades or architectural features.

1.18.4. This Division shall prepare sleeving Drawings indicating the size and locations of openings required in concrete floor slabs, roof slabs/decks and walls for conduit, bus ducts and equipment for review by the Consultant. In case of failure to provide information in time (i.e. before the concrete is poured) any extras incurred shall be at the expense of this Contractor.

1.19. PRODUCTS AND MATERIALS

1.19.1. Make and quality of materials used in the construction of this project shall be subject to the approval of the Consultant.

1.19.2. All equipment and material shall be CSA certified or approved by an accredited organization. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the Ontario Electrical Safety Authority.

1.19.3. Factory assemble control panels and component assemblies.

1.19.4. Materials and equipment supplied by this Division shall be new and free from defects and shall be Equivalent in physical characteristics and performance to that specified by the manufacturer's name and catalogue reference.

1.19.5. Where a certain manufacturer's equipment has been specified by name or model number, the Contractor shall be responsible for ensuring that the performance and quality meets the specified equipment and that the same access or maintenance space is available for an alternative manufacturer's equipment that is used and that interfacing connections with other trades can be made at no additional cost.

1.19.6. Within 30 days of the award of the Contract, the Contractor shall submit a complete list of the manufacturers for all equipment being supplied on the project.

1.19.7. Availability

.1 In submitting its Bid, the Contractor warrants that all materials are available in suitable time to meet the Contract dates.

.2 Subject to 1.19.7.3 below, where the Contractor advises that the Contractor cannot supply materials in suitable time to meet the Contract dates, and should it subsequently

appear that Work may be delayed for such reason, the Consultant reserves the right to substitute more readily available Products of similar character, even if more costly to the Contractor, at no increase in the Contract Price.

.3 Where the Contractor can show that it promptly ordered the originally specified materials, the Region will pay the differential in cost between the originally specified material and the substitute material without any mark-ups applicable by the Contractor, Subcontractors, sub-subcontractors or Suppliers. For greater certainty, the Contractor's failure to submit Shop Drawings or other submittals or seek direction in those instances where the Contract Documents so require in sufficient time to permit ordering materials is not cause for the Region to pay the cost differential in 1.19.7.2 above.

1.20. CO-OPERATION WITH CONSULTANTS

1.20.1. To assist in the successful execution of the Project, the Contractor shall receive a job report that summarizes the expectations of the Consultant and the Contractor. This document covers topics including, but not limited to, progress billings breakdowns, Shop Drawing requirements, change order pricing breakdowns, the commissioning process, installation Drawings, the Specifications, as-built Drawings and O+M manuals. This job report is intended to reiterate and elaborate on key items of the Contract Documents and is not intended to impose new requirements.

1.20.2. At the appropriate time during construction the Contractor shall submit the applicable documentation listed in the "Mechanical/Electrical Unfinished Building Occupancy Checklist". The list shall be issued by the Consultant during the project; however, a sample checklist can be provided at any time upon request. The checklist shall be completed by the Contractor when the information required for occupancy is submitted. The Consultant shall review the information and checklist and shall identify when the information is complete. The Consultant's general review letter (required for building occupancy) shall only be issued when all the information requested in the checklist is submitted by the Contractor and deemed to be complete by the Consultant.

1.21. CO-OPERATION WITH OTHER DIVISIONS

1.21.1. Particular attention must be paid to the proximity of electrical conduit and cable to mechanical piping and equipment.

1.21.2. Electrical conduits shall not touch or be supported on pipe or duct walls.

1.21.3. Each section shall confine itself to installing all materials in the spaces shown without encroaching upon space for materials installed under other sections or divisions. Where the space allocated to another section or division is encroached upon, the materials shall be relocated to their proper space allocation in such a manner to complete the Work using space allocated to the various sections and divisions. Relocation of materials and Work involved shall be paid for by the section responsible for the encroachment at no additional cost to the Region.

1.21.4. The supply of all items must have ample time for rapid progress of Work built-into the delivery schedule. Proceed with Work determined by the construction schedule.

1.21.5. The Contractor shall ensure that the electrical Subcontractor coordinates the exact breaker/fuse sizes with all mechanical equipment Shop Drawings prior to rough-in and ordering of the electrical distribution equipment. Size of breakers/fuses shown on the Drawings are based on generic equipment manufacturers and sizes may change depending on successful equipment manufacturer. No additional costs shall be allowed for non-coordinated mechanical Shop Drawing reviews by the Contractor or the electrical Subcontractor.

1.22. TEMPORARY USE OF EQUIPMENT

1.22.1. Where the electrical systems are operated during construction, the Contractor shall ensure that the electrical Subcontractor maintains the system and equipment in proper operating condition.

1.22.2. Before any area of the building is turned over to the Region for acceptance and for beginning of the guarantee/warranty period, the systems and equipment shall be returned to the initial new condition.

1.22.3. Permanent electrical equipment shall only be used upon permission of the Region and the Consultant and shall only be used on a limited basis. All equipment must be cleaned prior to turnover.

1.23. METRIC CONVERSIONS

1.23.1. Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, but not limited to, equipment, conduit and Site services in both new and existing installations.

1.24. INTERRUPTION OF SERVICES

1.24.1. Any interruption of the electrical services to any part of the building shall come at a time agreeable to the Consultant. Make all necessary arrangements with those concerned and include for any overtime required to ensure that the interruption is held to a minimum.

1.24.2. Testing and operation of major equipment shall be approved by the Consultant to avoid excessive electrical utility charges. Such testing shall be generally carried out after normal working hours or on weekends.

1.24.3. All such overtime work shall be carried out at no additional cost to the Region.

1.24.4. All construction Work, including modifications to existing electrical equipment, which will require shutdown, must be coordinated with the Region and will only be permitted on weekdays (Monday to Friday) from 4:30 pm to 8:00 am and on weekends (Saturday and Sunday). Exact weekend hours shall be co-ordinated with the Region. The Contractor shall pay for all utility costs associated with shutdowns. Provide a minimum of two (2) Working Days advance notice to the Region for all Site Work.

1.24.5. The Contractor shall provide a minimum of 5 days written notice of a requirement for a shutdown. The Contractor shall provide for separate meetings with the Region and the Consultant to discuss the shutdown in detail and to coordinate all the Work being performed.

1.24.6. The Contractor shall co-ordinate and isolate all existing services at all voltage levels required for the disconnections and connections to existing buildings. This includes shutting down and isolating existing low and medium voltage services. The Region will not perform any isolations for the Contractor but will be present during the Work. The Contractor shall use qualified personnel for these shutdowns ensuring compliance with all applicable safety requirements.

1.24.7. The Contractor is responsible for any damages caused to existing systems when making connections.

1.24.8. The Contractor shall keep shutdowns of existing buildings to a minimum by scheduling the Work and providing the required number of personnel to keep the shutdown to a minimum. The Contractor shall include for as many multiple teams of electricians as is feasible to keep the shutdown Work to a minimum.

1.25. DEMOLITION

1.25.1. The demolition Drawings show the general scope of the demolition and not exact details or total extent. For exact details and total extent, each service must be carefully checked on Site. Before removing services, follow the service through to ensure other areas of the building are not affected.

1.25.2. Whenever existing services or equipment are to be removed, all electrical connections for such services shall be removed and securely terminated in an approved manner. If necessary, to facilitate installation of new Work, any existing services and equipment shall be removed and then replaced under this Division.

1.25.3. Whenever it becomes necessary to relocate any electrical services equipment to make possible installation of the Work under this Contract, such relocation shall be done by this Division without additional cost to the Region.

1.25.4. Make safe and disconnect all power and systems, as and when, and to the extent required to facilitate the demolition.

1.25.5. Ensure that all electrical, life safety services, and services for existing equipment, in areas outside the areas of this Work, that are required to remain in service, shall do so.

1.25.6. Relocate any electrical feeders or equipment that are required to remain in service, that are secured to existing walls, floors or ceilings to be demolished or that are buried and required to be excavated for new Work.

1.25.7. Remove and replace any electrical equipment on walls or ceilings that will be demolished and rebuilt.

1.25.8. Disconnect and remove existing light fixtures, devices, outlets, CCTV, security devices, etc. which are not to be reused. Such items shall be packaged and turned over to the Region at a place designated by the Region. Cut back and cap unused raceway and outlets and remove unused wiring back to panelboard in an ESA approved manner.

1.25.9. Ensure that all existing equipment which shall be reused and/or relocated is thoroughly reviewed and refurbished to ensure correct operation when put back into service and to meet the requirements of the Newmarket Building Department and the Electrical Safety Authority. All existing electrical equipment which is no longer required shall be removed and disposed of off-Site.

1.25.10. Carry out the Work with a minimum of noise, dust and disturbance.

1.25.11. Provide tools and clean up equipment. Obtain the Region's permission for the use of electrical, plumbing or drainage outlets.

1.25.12. Where a device is shown to be relocated on the Drawings, the Contractor shall remove and re-install device and back box and re-feed the device with new conduit and wire from the nearest existing accessible junction box.

1.25.13. The Contractor shall patch and re-paint the entire wall where a device and/or box has been added, removed or relocated.

2. Products

2.1. NOT USED

3. Execution

3.1. NOT USED

END OF SECTION

1. General

1.1. DEFINITIONS

1.1.1. Generally, the following definitions are used in this Division:

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.
Channel	-	Complete end to end connection including patch cords, cable and termination device(s).
Cut Over	-	The live date(s) when the Region 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.
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.

1.2. ABBREVIATIONS

1.2.1. Generally, the following abbreviations are used in this Division:

A	-	Ampere
ac	-	Alternating current
ACM	-	Aluminum Conductor Material
AFF	-	Above Finished Floor
AHJ	-	Authority Having Jurisdiction
ALPETH	-	Aluminum Polyethylene
AME	-	Architectural, Mechanical, Electrical
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
AV	-	Audiovisual
AWG	-	American Wire Gauge
BAS	-	Building Automation System
dB	-	Decibel
BC	-	Bonding Conductor
BCD	-	Backbone Conduit
BF	-	Ballast Factor
BOM	-	Bill Of Material
BX	-	Armored Cable or Flexible Metal Conduit Cable
CAD	-	Computer Aided Design
CBM	-	Certified Ballast Manufacturers Association
CCTV	-	Closed Circuit Television
CCDC	-	Canadian Construction Documents Committee
CD	-	Compact Disc
cd		Candela
CEC	-	Canadian Electrical Code
cm	-	Centimetre
coax	-	Coaxial Cable
CRI	-	Color Rendering Index
CSA	-	Canadian Standards Association
CSC	-	Construction Specifications Canada
CSI	-	Construction Specifications Institute
Cu	-	Copper
CUL	-	Underwriters Laboratories Canada
DALI	-	Digital Addressable Lighting Interface
dB	-	Decibel
dBA	-	Decibel (A-Weighted)
dc	-	Direct Current
DCL-C	-	Data Communications Link - Style C Wiring
DMX	-	Digital Multiplex Signal
DVD	-	Digital Versatile Disc
EIA	-	Electronics Industry Alliance
ELV	-	Electrical Low Voltage
e-mail	-	Electronic Mail
EMI	-	Electromagnetic Interference
EMI/RFI	-	Electromagnetic Interference / Radio Frequency Interference
EMT	-	Electrical Metallic Tubing
ENT	-	Electrical Non-metallic Tubing
ER	-	Equipment Room
ESA	-	Electrical Safety Authority
e/w	-	Equipped With

FAS	-	Fire Alarm Signaling
FCC	-	Federal Communications Commission
FD	-	Deep Type Electrical Device Box
FS	-	Shallow Type Electrical Device Box
ft	-	Foot / Feet
ft^2	-	Square Foot / Feet
GPR	-	Ground Penetrating Radar
HID	-	High Intensity Discharge
Hz	-	Hertz
I	-	Current
IDC	-	Insulation Displacement Contact
IEEE®	-	Institute of Electrical and Electronics Engineers, Inc. ®
IES	-	Illuminating Engineering Society
IESNA	-	Illuminating Engineering Society of North America
IG	-	Isolated Ground
in	-	Inch
in^2	-	Square Inch
I/O	-	Input / Output (Device)
ISO	-	International Organization for Standardization
IT	-	Information Technology
kg	-	Kilogram
Km	-	Kilometre
kV	-	Kilovolt
kVA	-	Kilovoltampere
kW	-	Kilowatt
kWh	-	Kilowatt hour
LAN	-	Local Area Network
lb	-	Pound
LED	-	Light Emitting Diode
LV	-	Low Voltage
m	-	Metre
m^2	-	Square Metre
mA	-	Milliampere
MCC	-	Motor Control Center
MGB	-	Main Grounding Busbar
MHz	-	Megahertz
MI Cable	-	Mineral Insulated Cable
mi	-	Mile
min	-	Minute
mm	-	Millimetre
MLV	-	Magnetic Low Voltage
ms	-	Millisecond
MSDS	-	Material Safety Data Sheet
mW	-	Milliwatt
MW	-	Megawatt
NBCC	-	National Building Code of Canada
NEMA	-	National Electrical Manufacturers Association
NESC	-	National Electrical Safety Code
NPS	-	Nominal Pipe Size
NUAL	-	Brand Refers to General Cable Inc. Manufactured Aluminum Alloy Conductor Material
OEM	-	Original Equipment Manufacturer
OESC	-	Ontario Electrical Safety Code
O+M	-	Operation and Maintenance
PCB	-	Polychlorinated Biphenyl
PDU	-	Power Distribution Unit
PF	-	Power Factor

PVC	-	Polyvinyl Chloride
QA	-	Quality Assurance
QC	-	Quality Control
RGBW	-	Red, Green, Blue, White
rms	-	Root Mean Square
RX	-	Receive
SCC	-	Standards Council of Canada
S.I.	-	The International System of Units
SWBD	-	Switchboard
THD	-	Total Harmonic Distortion
TIA	-	Telecommunications Industry Association
TV	-	Television
TX	-	Transmit
UD	-	Underfloor Duct
UL®	-	Underwriters Laboratories Inc.®
ULC	-	Underwriters Laboratories of Canada
UPC	-	Universal Product Code
UPS	-	Uninterruptible Power Supply
USB	-	Universal Serial Bus
UTP	-	Unshielded Twisted Pair
V	-	Volt
VA	-	Volt-Ampere
VFD	-	Variable Frequency Drive
VOC	-	Volatile Organic Compounds
Vrms	-	Voltage (Square-Mean-Root)
W	-	Watt
WAP	-	Wireless Application Protocol
Wi-Fi	-	Wireless Fidelity
WHMIS	-	Workplace Hazardous Materials Information System

2. Products

2.1. NOT USED

3. Execution

3.1. NOT USED

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Refer to Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. RECORD DRAWINGS

2.1.1. The Contractor shall request in writing from the Consultant all electrical AutoCAD Drawings. After the final as-built Drawings have been reviewed, provide three (3) copies of the Drawings on CD or DVD or USB stick. One copy shall be returned to the Consultant for their records and a minimum of one copy with each set of maintenance manuals. The Contractor shall use the latest release of AutoCAD software, and provide electronic files saved in a version acceptable to the Region and the Consultant.

2.1.2. The Contractor shall identify the cost of record drawings and the operation and maintenance manuals as a separate line item on their progress draw. The following values shall be broken out:

$5,000	For Electrical Contracts up to $250,000
2% of Electrical Contract	For Electrical Contracts from $250,000 to $1,500,000
$30,000	For Electrical Contracts over $1,500,000

The final versions, both hard and electronic, of the drawings and manuals shall be submitted in a form acceptable to the Region prior to application for Substantial Performance of the Work.

2.1.3. Final as-built prints/plots shall not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.). References to the Consultant must be deleted from the Drawings.

2.1.4. Final as-built Drawings to include all revisions made to the Drawings during construction, including all approved changes. The as-built Drawings shall also include the routing of all feeders except for branch circuits, all junction boxes shall be shown, drawing legend shall be updated to include all symbols and lines used to show as-built conditions, quantity of wires in each conduit, and circuit numbers of wires in each conduit. Include slab layout Drawings in as-built drawing package.

2.1.5. CAD Requirements.

.1 A complete list of layer names and brief description of each layer's use shall accompany all files.

.2 Fonts for text shall be AutoCAD standard. Custom fonts, shape files, etc., shall not be used.

.3 Final as-built Drawings shall be returned on CD ROM or DVD or USB stick.

.4 Each CD ROM or DVD or USB stick shall be clearly labelled with the names of the Consultant and the Region, Contract number, file names and Drawing number. If a complete listing exceeds the label size provide a "readme.txt" file in ASCII format with each CD ROM or DVD or USB stick. A printed copy of the readme file shall accompany each CD ROM or DVD or USB stick.

.5 All Drawings shall be in the same units as issued on the Contract Documents.

.6 Provide a complete list of symbol (block) names with a description of each symbol.

.7 Special effort shall be made to ensure that drafting is accurate: i.e. appropriate lines are indeed horizontal and vertical; lines that should intersect do but not over-intersect and ensure that entities are placed on correct layers.

2.1.6. The Contractor shall maintain two sets of white prints on Site on which it shall clearly mark, as the job progresses, all changes and deviations from that shown on the Drawings. After review and approval of service lines in trenches, the Contractor shall take 'as-built' measurements, including all depths, prior to commencement of backfilling operations. The location of buried electrical ducts and conductors shall be shown on the Drawings and dimensioned from fixed points. The Drawings shall be kept up-to-date during construction and in addition to field measurements shall include variation orders, field instructions and all other changes.

2.1.7. On completion of the Division 26 work, the Contractor shall forward to the Consultant the two sets of final Drawings indicating all such changes and deviations for review by the Consultant. Each set shall include a full size hard copy of the Drawings, and an electronic copy of the Drawings on a CD ROM or DVD or USB stick.

2.1.8. The Contractor may request from the Consultant the most current electrical Drawings in AutoCAD, IBM PC DVD format (at no charge).

2.1.9. The AutoCAD as-built documents shall meet all the Region’s and the Consultant’s requirements.

3. Execution

3.1. NOT USED

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. RELATED WORK

1.2.1. Comply with this Specification for submittal requirements and as amended below.

2. Products

2.1. SHOP DRAWINGS

2.1.1. Shop Drawings shall be organized by Specification Section. Do not combine more than one section into one submission. Incorrect submissions will be returned without review.

2.1.2. Submittals/Shop Drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each Shop Drawing shall give the identifying number of the specific assembly for which it was prepared (e.g. SWBD-1A).

2.1.3. Submit shop drawings electronically, by email, in PDF format. Submissions that are not electronic without prior approval from the Consultant shall be returned as not reviewed. Provide the following information in the email submission:

.1 Consultant project number and Contractor Shop Drawing Identifier in Subject Line

.2 Attachments shall be limited to 10MB

.3 Provide FTP hyperlink for all attachments in excess of 10MB with appropriate information for downloading the file (as required)

.4 Shop Drawing submission to Smith + Andersen personnel's email as identified on the construction team contact list provided upon commencement of the Work.

2.1.4. Intentionally deleted.

2.1.5. Each Shop Drawing for non-catalogue items shall be prepared specifically for this project. Shop Drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.

2.1.6. When requested, Shop Drawings shall be supplemented by data explaining the theory of operation – for example: lighting control sequence of operation – the Consultant may also request that this information be added to the maintenance and operating manual.

2.1.7. Provide a cover sheet with the project name, issue date, issue number, Specification section number, title of section and with space for Shop Drawing review stamps for the Contractor and the Consultant.

3. Execution

3.1. SUBMISSION

3.1.1. Each Shop Drawing or catalogue sheet shall be in original PDF format stamped and signed by the Contractor to indicate that it has checked the Drawing for conformance with all requirements of the Drawings and Specifications, that it has co-ordinated this equipment with other equipment to which it is attached and/or connected and that it has verified all dimensions to ensure the proper installation of equipment within the available space and without

interference with the Work of other trades. Ensure that electrical and mechanical co-ordination is complete before submitting Drawings for review.

3.1.2. Scanned PDF versions are not permitted.

3.1.3. Equipment shall not be released for manufacture until the Shop Drawing has been reviewed by Consultant. The Contractor shall assume responsibility and cost for field changes. Installation of any equipment shall not start until after final review of Shop Drawings by the Consultant has been obtained.

3.1.4. As part of the Consultant's scope of the Work, Shop Drawings shall be reviewed no more than twice. Should three or more reviews be required due to reasons of Contractor omissions causing resubmission requests, the Contractor shall reimburse the Consultant for time expended in these extra reviews.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. MOUNTING HEIGHTS

2.1.1. Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise on the Drawings.

2.1.2. If mounting height of equipment is not specified or indicated on the Drawings or Specifications, verify with the Consultant before proceeding with installation.

2.1.3. Unless indicated otherwise on the Drawings or within the Specifications, install electrical equipment at following heights.

- .1 Local switches: 1050 mm.
- .2 Wall receptacles:
  - .1 General: 450 mm.
  - .2 Above top of continuous baseboard heater: 200 mm.
  - .3 Above top of counters or counter splash backs: 175 mm.
  - .4 In mechanical rooms: 1200 mm.
  - .5 In equipment storage rooms: 900mm.
- .3 Panelboards: 2000 mm to top of panel.
- .4 General wall mounted data and voice outlets: 450 mm.
- .5 Fire alarm stations: 1200 mm.
- .6 Wall mounted fire alarm audible devices: 2300 mm.
- .7 Television outlets not mounted behind a wall mounted television: 450 mm.
- .8 Wall mounted speakers: 2100 mm.
- .9 Clocks: 2100 mm.
- .10 Power door operator pushbuttons: 1080 mm.
- .11 Wall mounted exit signs
  - .1 For 2400 mm to 2500 mm ceiling heights: 2100 mm.
  - .2 For all ceilings heights greater than 2500 mm: 2400 mm.
- .12 Wall mounted Battery packs and emergency Heads
  - .1 For 2400 mm to 2500 mm ceiling heights: 2100 mm.
  - .2 For all ceilings heights greater than 2500 mm: 2400 mm.
- .13 Wall mounted occupancy sensors: 1050 mm.
- .14 Wall mounted visible signal devices: entire lens shall be no less than 2000 mm and no more than 2400 mm.
- .15 Top of remote annunciator and passive graphic panels shall be no more than 1800mm above finished floor.
- .16 Wall mounted emergency telephone (Fireman's Handset): 1350 to 1500mm.

3. Execution

3.1. NOT USED

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

1.2.1. CSA C22.2 No.0.3, Test Methods for Electrical Wires and Cables, latest edition.

1.2.2. CSA C22.2 No. 38, Thermoset-Insulated Wires and Cables, latest edition.

1.2.3. CSA-C22.2 No. 51, Armoured Cables, latest edition.

1.2.4. CSA C22.2 No. 75, Thermoplastic-Insulated Wires and Cables, latest edition.

1.2.5. CSA-C22.2 No. 96, Portable Power Cables, latest edition.

1.2.6. CSA-C22.2 No. 123, Metal Sheathed Cables, latest edition.

1.2.7. CSA-C22.2 No. 174, Cables and Cable Glands for Use in Hazardous Locations, latest edition.

1.2.8. Ontario Electrical Safety Code, latest edition.

1.2.9. CAN/ULC S139, Standard Method of Fire Test for Evaluation of Integrity of Electrical Power, Data, and Optical Fibre Cables, latest edition.

1.2.10. UL 2196, Standard for Tests for Fire Resistive Cables, latest edition.

1.2.11. ASTM B800 - Standard Specification for 8000 Series Aluminium Alloy Wire for Electrical Purposes-Annealed and Intermediate Tempers, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and Product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

2. Products

2.1. BUILDING WIRES

2.1.1. Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

2.1.2. The Contractor shall provide copper conductors on conductors sizes up to and including #8 AWG. The Contractor shall provide copper conductors for sizes larger than #8 AWG unless identified as aluminium or NUAL on the Drawings.

2.1.3. All conductors shall have size as indicated on the Drawings, with insulation of chemically cross-linked thermosetting polyethylene material rated RW90 to CSA-C22.2 No.38 or heat and moisture-resistant thermoplastic polyvinyl chloride (PVC) insulation with an outer nylon jacket rated T90 to CSA-C22.2 No.75 rated as follows:

.1 Insulation rated at 1000V for 600V systems that are ungrounded or have a neutral grounding resistor to limit ground fault current

.2 Insulation rated at 600V for the other 600V and 347/600V distribution systems not covered under item #1 above.

.3 Insulation rated at 600V for all systems rated at 480V and less.

2.1.4. All aluminium or NUAL conductors shall be an aluminium alloy with CSA certified as an Aluminium conductor material (ACM) and meet the requirements of the Aluminium Association Inc. AA8030 and ASTM B800 standards. Provide an anti-oxidant compound, Ideal Industries Inc. NOALOX or equivalent, on all aluminum conductor terminations.

2.2. FIRE RATED MC CABLE

2.2.1. Conductors: stranded annealed copper, size as indicated on the Drawings.

2.2.2. Insulation: low smoke silicon rubber.

2.2.3. Armour: continuously welded and corrugated copper sheath,

2.2.4. Outer Jacket: Black low smoke, zero halogen polyolefin, FT4 rated

2.2.5. Two hour fire rating.

2.2.6. Conform to requirements of CSA-C22.2 No. 123; UL 2196 and ULC S 139 with hose stream.

2.3. ARMOURED CABLES

2.3.1. Cables to: CSA-C22.2 No. 51.

2.3.2. Circuit conductors: copper, size as indicated on the Drawings unless aluminium or NUAL is identified on the Drawings. Aluminium or NUAL conductor shall be provided as per item 2.1.4.

2.3.3. Type: AC90 (BX).

2.3.4. Armour: interlocking type fabricated from aluminium strip.

2.3.5. Type: ACWU90 - PVC flame retardant 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.

2.4. ALUMINUM SHEATHED CABLE

2.4.1. Circuit conductors: copper, size as indicated on the Drawings unless aluminium or NUAL is identified on the Drawings. Aluminium or NUAL conductor shall be provided as per item 2.1.4.

2.4.2. Insulation: type RA90 rated 1000 V.

2.4.3. Sheath: aluminium applied to form continuous corrugated seamless sheath.

2.4.4. Outer jacket of PVC applied over sheath for direct burial or wet locations.

2.5. WIRING TERMINATION

2.5.1. Lugs, terminals, screws used for termination of wiring shall be suitable for either copper or aluminum conductors.

2.5.2. Lugs, terminals, screws used for termination of multiple wires must be rated for their intended use.

3. Execution

3.1. GENERAL

3.1.1. Provide a minimum of one bonding conductor for each three ungrounded conductors on all conduit and cable runs. Size bonding conductor to applicable tables of the Ontario Electrical Safety Code. Provide separate bonding conductors for each ground fault circuit interrupter circuits. All bonding conductors shall be copper and insulated with a green coloured insulation.

3.1.2. All equipment, junction boxes, pull boxes, liquid tight flex, etc. shall be bonded to ground through bonding conductors.

3.1.3. Provide separate neutral conductor for each 120 volt circuit for all circuits feeding receptacles and power outlets.

3.1.4. All cable terminations shall be compression type fittings for wire sizes greater than #8 AWG. All compression type fittings to be two-hole long barrel type with inspection / viewing window. Where mechanical screw type lugs are allowed by the Consultant, they will be suitable for quantity of parallel runs of wire that are to be terminated under.

3.1.5. Armoured Cable Type AC90 (BX) may only be used for individual drops from slab mounted junction box to recessed mounted light fixtures or where noted on the Drawings where wiring is required to be installed within an existing wall. The maximum allowable distance of armoured cable is 3m. The Contractor shall receive written approval from the Consultant to run armoured cable further than 3m from junction box. Daisy chaining of fixtures is only acceptable in dry wall ceilings. Wiring in conduit shall be brought to a junction box to allow for the transition to armoured cable. Armoured cable shall not be installed directly into electrical panels or run in walls for receptacles.

3.1.6. Branch circuit wiring shall be upsized as follows to address voltage drop when:

.1 The entire length of the circuit wiring exceeds 25 m – branch wiring shall be a minimum of No. 10 AWG.

.2 The entire length of the circuit wiring exceeds 40 m – branch wiring shall be a minimum of No. 8 AWG.

.3 The entire length of the circuit wiring exceeds 60 m – branch wiring shall be a minimum of No. 6 AWG.

3.1.7. Wire Splicing

.1 Splice up to and including No. 6 AWG with nylon insulated expandable spring type connectors.

.2 Splice larger conductors using compression type connectors wrapped in PVC insulation rated at the respective voltage.

3.2. INSTALLATION OF BUILDING WIRES

3.2.1. Install all building wiring in conduit unless otherwise noted on the Drawings. Conduit shall be sized to the Ontario Electrical Safety Code unless noted on the Drawings or in the Specifications.

3.2.2. All conductors shall be colour coded. Provide colour tape at all terminations to identify all conductors in each run.

3.3. INSTALLATION OF ARMOURED CABLE OR ALUMINUM SHEATHED CABLE

3.3.1. Group cables wherever possible on channels.

3.3.2. Terminate cables in accordance with manufacturer’s instructions.

3.3.3. Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables.

.3 Galvanized threaded rods: 6 mm dia. minimum to support suspended channels.

3.3.4. Connectors:

.1 Watertight, approved for respective cables.

3.3.5. For single conductor cables, ground the sheath at the upstream (source) panel and provide insulated fibre plate at the load end, so as to prevent circulating sheath currents.

3.4. FIELD QUALITY CONTROL

3.4.1. Prior to energizing wires/cables, measure insulation resistance of each wire/cable. Ensure readings are acceptable per installation recommendations. Tabulate and submit for approval as a submittal.

3.4.2. All wires and cables shall be tested. The Contractor shall oversee all testing and correct any deficiencies noted.

3.5. INSTALLATION OF CONTROL CABLES

3.5.1. Install control cables in conduit.

3.5.2. Ground control cable shield.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 41– Grounding and Bonding of Equipment, latest edition.

1.2.2. Ontario Electrical Safety Code, latest edition.

1.2.3. IEEE Standard 81 – IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System, latest edition.

1.3. DESCRIPTION

1.3.1. Provide system grounding to meet requirements of current applicable codes.

1.4. SHOP DRAWINGS AND PRODUCT DATA

1.4.1. Submit Shop Drawings and Product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.4.2. Submit main system ground test report as a Shop Drawing for the Consultant's review. Include final reviewed report in the project operation and maintenance manuals.

2. Products

2.1. GROUNDING AND BONDING EQUIPMENT

2.1.1. Meet standard of CSA C22.2 No. 41 – Grounding and Bonding of Equipment, latest edition.

2.2. CONDUCTORS

2.2.1. Bare or insulated, stranded, soft drawn annealed copper wire, for: ground bus, electrode interconnections, metal structures, ground connections, telephone ground.

2.3. LUGS

2.3.1. All grounding connections shall be made with compression type fittings and lugs with inspection/viewing window.

3. Execution

3.1. INSTALLATION

3.1.1. Install complete permanent, continuous, system and circuit, equipment, grounding and bonding systems including, conductors, connectors, and accessories, as indicated on the Drawings, to conform to requirements of the ESA over installation.

3.1.2. For solidly grounded systems, transformer neutrals, switchboard neutrals and all similar bonding connections, the bonding conductors shall be sized in accordance with Table 16 of the Ontario Electrical Safety Code.

3.1.3. Provide cable grips to receive all grounding conductors. Identify all grounding conductors at the ground pad using lamacoid nameplates. Ground bus system shall be provided in rooms as shown on the Drawings.

3.1.4. Terminate the following conductors at the ground bus system:

- Service neutral -as indicated on the Drawings
- Telecommunications ground -as per EIA/TIA standard 607-A (latest edition)

TBB/GE linear length m (ft)	TBB/GE 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
20 – 26 (67 – 84)	3/0
26 – 32 (85 – 105)	4/0
32 – 38 (106 – 125)	250 kcmil
38 – 46 (126 – 150)	300 kcmil
46 – 53 (151 – 175)	350 kcmil
53 – 76 (176 – 250)	500 kcmil
76 – 91 (251 – 300)	600 kcmil
Greater than 91 (301)	750 kcmil

where,
TBB = Telecommunications Bonding Backbone

- Main system ground -#2/0 AWG or 2 x # 4/0 AWG for remote ground grids
- Bonding conductor -as per Table 16 of CSA C22.1

3.1.5. Ground all metallic water, gas, and waste systems with a minimum #2/0 AWG copper in accordance with the Ontario Electrical Safety Code requirements.

3.1.6. Install bonding connections to typical equipment included in, but not necessarily limited to, following list: frames of motors, starters, control panels, building steel work, elevators, distribution panels and outdoor lighting.

3.1.7. Commission an approved certified testing agency to perform a main system ground test. Submit the main system ground test report as a Shop Drawing for the Consultant's review. Provide a copy of the report in the operation and maintenance manual. (Refer to Part 3.2).

3.1.8. Install connectors in accordance with manufacturer's instructions.

3.1.9. Protect exposed grounding conductors from mechanical injury.

3.1.10. Install bonding conductor for flexible conduit and connect at both ends to grounding bushing with solderless lug, clamp or cup washer and screw. Neatly cleat bonding conductor to exterior of flexible conduit.

3.1.11. Provide separate, insulated bonding conductor within each feeder and branch circuit raceway.

3.1.12. Interface with the lightning protection system, if one is installed for the building.

3.2. TESTING

3.2.1. Following are acceptable methods of testing the ground grid. Testing shall be in accordance with IEEE Standard 81 (latest edition).

.1 Two-Point Method

.2 Three-Point Method

.3 Ratio Method

.4 Staged Fault Tests

.5 Fall-of-Potential Method

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. SHOP DRAWINGS AND PRODUCT DATA

1.2.1. Submit Shop Drawings and Product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2.2. Conduit and equipment provided under this electrical Division shall be complete with all necessary supports and hangers required for a safe and workmanlike installation.

2. Products

2.1. MATERIALS

2.1.1. Provide “U” type support Strut as manufactured by Atkore International Inc. – Unistrut brand – or Equivalent.

3. Execution

3.1. INSTALLATION

3.1.1. The Contractor shall supply anchor bolts and base diagrams of equipment showing the exact location of the anchor bolts.

3.1.2. It shall be the responsibility of the electrical Division to supply the Contractor with anchor bolts and base diagrams of equipment showing the exact location of the anchor bolts.

3.1.3. All drilling for hangers, rod inserts and Work of similar nature shall be completed by this Division.

3.1.4. Auxiliary structural members shall be provided under the electrical section concerned where conduits or equipment must be suspended between the joists or beams of the structure, or where required to replace individual hanger to allow for installation on new services. Submit details for review as requested.

3.1.5. Depending on type of structure, hangers shall be either clamped to steel beams or joists, or attached to approved concrete inserts.

3.1.6. Approved type expansion shields and bolts may be used for conduit up to 100 mm diameter where the pre-setting of concrete inserts is not practical. Submit Shop Drawings.

3.1.7. Suspension from metal deck shall not be allowed unless specifically accepted by the Consultant. Drawings of the proposed method of suspension must be submitted for review.

3.1.8. Suspending one hanger from another shall not be permitted.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.3. Section 26 05 53.00 – IDENTIFICATION.

1.1.4. Section 26 05 63.00 – ACCESS DOORS AND ACCESSIBILITY.

1.2. REFERENCE

1.2.1. Ontario Electrical Safety Code, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and Product data for cabinets in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

2. Products

2.1. SPLITTERS

2.1.1. Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position. Provide CSA Type 1 enclosures in non-sprinklered environments and CSA Type 4/12 in sprinklered environments.

2.1.2. Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated on the Drawings.

2.1.3. At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2. JUNCTION AND PULL BOXES

2.2.1. Welded steel construction with screw-on flat covers for surface mounting.

2.2.2. Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3. CABINETS

2.3.1. Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

2.3.2. Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm plywood backboard for surface or flush mounting. The plywood backboard shall have a fire-resistant coating on the front. Do not paint over plywood fire rating certification stamp.

3. Execution

3.1. SPLITTER INSTALLATION

3.1.1. Install splitters and mount plumb, true and square to the building lines.

3.1.2. Extend splitters full length of equipment arrangement except where indicated otherwise on the Drawings.

3.2. JUNCTION, PULL BOXES AND CABINETS INSTALLATION

3.2.1. Install pull boxes in inconspicuous but accessible locations.

3.2.2. Mount cabinets with top not higher than 2000 mm above finished floor.

3.2.3. Install terminal block as indicated in Type T cabinets.

3.2.4. Only main junction and pull boxes are indicated. Install pull boxes as follows:

.1 A conduit run exceeds 30 m and;

.2 360 degree of combined bends between pull boxes for power conduits or 180 degree of combined bends between pull boxes for communication and low voltage conduits.

3.3. IDENTIFICATION

3.3.1. Provide equipment identification in accordance with Section 26 05 53.00 – IDENTIFICATION.

3.3.2. Install identification labels indicating system name, voltage and phase.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

1.2.1. Ontario Electrical Safety Code, latest edition.

1.2.2. Ontario Building Code, latest edition.

1.2.3. CAN/ULC-S115, Fire Tests of Fire Stop Systems, latest edition.

2. Products

2.1. OUTLET AND CONDUIT BOXES GENERAL

2.1.1. Size boxes in accordance with the Ontario Electrical Safety Code.

2.1.2. Square or larger outlet boxes as required for special devices.

2.1.3. Gang boxes where wiring devices are grouped.

2.1.4. Blank cover plates for boxes without wiring devices.

2.1.5. 347V outlet boxes for 347 V switching devices.

2.1.6. Combination boxes with barriers where outlets for more than one system are grouped.

2.2. SHEET STEEL OUTLET BOXES

2.2.1. Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 75 mm x 50 mm x 38 mm or as indicated on the Drawings. 100 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

2.2.2. Provide cast FS aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles connected to rigid conduit.

2.2.3. Provide electro-galvanized steel utility boxes for surface mounted boxes connected to surface-mounted EMT conduit, minimum size 100 mm x 54 mm x 48 mm.

2.2.4. Square or octagonal outlet boxes for lighting fixture outlets.

2.2.5. Square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3. MASONRY BOXES

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

2.4. FLOOR BOXES

2.4.1. Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brushed aluminum faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 28 mm for receptacles; 73 mm for communication equipment.

2.4.2. Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 12.7 mm and 19 mm conduit. Minimum size: 73 mm deep.

2.5. OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

2.5.1. Electro-galvanized, sectional, screw ganging steel boxes, minimum size 75 mm x 50 mm x 63.5 mm with two double clamps to take non-metallic sheathed cables.

2.6. FITTINGS - GENERAL

2.6.1. Bushing and connectors with nylon insulated throats.

2.6.2. Knock-out fillers to prevent entry of debris.

2.6.3. Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

2.6.4. Double locknuts and insulated bushings on sheet metal boxes.

2.7. SERVICE FITTINGS

2.7.1. 'High tension' receptacle fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish for duplex receptacles. Bottom plate with two knockouts for centered or offset installation.

2.7.2. Pedestal type 'low tension' fitting made of 2 piece die cast aluminum with brushed aluminum housing finish to accommodate Amphenol jack connectors or Equivalent.

3. Execution

3.1. INSTALLATION

3.1.1. Support boxes independently of connecting conduits.

3.1.2. Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of Work.

3.1.3. For flush installations, mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

3.1.4. Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not permitted.

3.1.5. Non-combustible electrical outlet boxes that penetrate a fire separation or a membrane forming part of an assembly required to have a fire-resistance rating, do not require fire stops provided,

.1 they do not exceed:

.1 100 cm^2 each in area, AND

.2 an aggregate area of 650 cm^2 in any 9.3 m^2 of surface area, AND

.2 the annular space between the membrane and the box does not exceed 3 mm.

3.1.6. Where the conditions of clause 3.1.5 are not met, provide fire stops for the outlet boxes.

3.1.7. Opposing outlets on non-fire rated partition walls shall have a minimum 150 mm horizontal separation. Outlets shall not be mounted back to back.

3.1.8. Conform to the fire stopping requirements of the Ontario Building Code: unless provided with a fire stop in accordance with CAN/ULC-S115, “Fire Tests of Fire Stop Systems”, electrical outlet boxes on opposite sides of a vertical fire separation required to have a fire-resistance rating shall be separated by a horizontal distance of not less than 600 mm, or be installed in adjacent stud cavities.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 31.00 – SPLITTERS, JUNCTION, PULL BOXES AND CABINETS

1.1.3. Section 26 05 32.00 – OUTLET BOXES, CONDUIT BOXES AND FITTINGS

1.2. REFERENCES

1.2.1. CAN/CSA C22.2 No.18- Outlet Boxes, Conduit Boxes, and Fittings, latest edition.

1.2.2. CSA C22.2 No.45.1- Electrical Rigid Metal Conduit - Steel, latest edition.

1.2.3. CSA C22.2 No.56- Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit, latest edition.

1.2.4. CSA C22.2 No.83- Electrical Metallic Tubing, latest edition.

1.2.5. CSA C22.2 No.211.2- Rigid PVC (Unplasticized) Conduit, latest edition.

1.2.6. CAN/CSA C22.2 No.227.3- Flexible Non-metallic Tubing, latest edition.

1.2.7. CSA C22.2 No.227.1 - Electrical Non-Metallic Tubing, latest edition.

2. Products

2.1. CONDUITS

2.1.1. Electrical rigid metal conduit: to CSA C22.2 No.45.1, galvanized steel or aluminum threaded.

2.1.2. Epoxy coated conduit: to CSA C22.2 No.45, with zinc coating and corrosion resistant epoxy finish inside and outside.

2.1.3. Electrical metallic tubing (EMT): to CSA C22.2 No.83, with couplings.

2.1.4. Rigid PVC conduit: to CSA C22.2 No.211.2.

2.1.5. Flexible metal conduit: to CSA C22.2 No.56, steel or liquid-tight flexible metal.

2.1.6. Electrical non-metallic tubing (ENT): to CSA C22.2 No. 227, with couplings.

2.2. CONDUIT FASTENINGS

2.2.1. One hole steel straps to secure surface conduits NPS 2 and smaller. Two hole steel straps for conduits larger than NPS 2.

2.2.2. Beam clamps to secure conduits to exposed steel work.

2.2.3. Channel type supports for two or more conduits at 1 m oc.

2.2.4. Hot dipped galvanized threaded rods, 6 mm dia. minimum, to support suspended channels.

2.3. CONDUIT FITTINGS

2.3.1. Fittings: manufactured for use with conduit specified. Coating: same as conduit.

2.3.2. Factory "ells" where 90 bends are required for 1” and larger conduits when a hydraulic bender is not used.

2.3.3. Connectors and couplings for EMT conduit are to be set-screw steel type. Below the level of suspended ceilings, in a sprinklered environment, provide watertight fittings and “O” rings on all conduit runs and when conduit is terminated at any piece of electrical equipment.

2.3.4. Provide plastic bushings for all connectors, rigid nipples and rigid conduit 32mm or larger.

2.4. EXPANSION FITTINGS FOR RIGID CONDUIT

2.4.1. Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

2.5. FISH CORD

2.5.1. Fish cord to be made of polypropylene.

3. Execution

3.1. INSTALLATION

3.1.1. All conduits on project to be surface mounted. No conduits in cast in-place concrete or in slab conduits will be permitted unless written consent is received from the Consultant and the Region. Only once approved by the Consultant and the Region do the clauses contained within this section and the respective sections relating to conduits in cast in-place concrete or in slab conduits apply.

3.1.2. Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

3.1.3. Conceal conduits except in mechanical and electrical service rooms or in unfinished areas. Conduits shall have their own support system and are to be supported independently of the ceiling grid or ceiling support system.

3.1.4. Where vertically run conduit passes through a slab, the Contractor shall provide a 100mm high concrete pad with the pad extending 100mm on all sides of the conduit.

3.1.5. Use electrical metallic tubing (EMT) conduit except where specified otherwise on the Drawings.

3.1.6. Use epoxy coated conduit in corrosive areas.

3.1.7. Use rigid galvanized steel threaded conduit where conduit is subject to mechanical injury.

3.1.8. Use rigid PVC conduit underground or in corrosive areas and where indicated on the Drawings.

3.1.9. Use flexible metal conduit for connection to motors or vibrating equipment in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.

3.1.10. Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations. Use only liquid tight fittings when using liquid tight flexible metal conduit. Liquid tight flexible metal conduit shall have a jacket with an FT6 rating when used in plenums otherwise provide a minimum FT4 rating.

3.1.11. Use explosion proof flexible connection for connection to explosion proof motors.

3.1.12. Install conduit sealing fittings in hazardous areas. Fill with compound.

3.1.13. Minimum conduit size for lighting and power circuits: NPS 21mm, unless otherwise noted on the Drawings.

3.1.14. Install EMT conduit from a raised floor branch circuit panel to outlet boxes located in sub floor.

3.1.15. Install EMT conduit from a raised floor branch circuit panel to junction box in sub-floor. Run flexible metal conduit from junction box to outlet boxes for equipment connections in sub-floor.

3.1.16. Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

3.1.17. Mechanically bend steel conduit over 19 mm dia.

3.1.18. Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

3.1.19. Install fish cord in empty conduits.

3.1.20. Run two 27mm spare conduits up to ceiling space and two 27mm spare conduits down to sub-floor space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes or in case of an exposed concrete slab, terminate each conduit in flush concrete or surface type box.

3.1.21. Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

3.1.22. Dry conduits out before installing wire.

3.1.23. All cutting and patching of masonry/concrete floors, walls, and roof for electrical services shall be by this Division. Obtain approval from the Region and/or the Consultant before cutting any structural walls or floors. Cutting and drilling shall only be at times allowed by the Region. Check and verify the location of existing mechanical and electrical services in walls and below the floor slab in all areas requiring core drilling and cutting. Protect all tenant areas where core drilling occurs. Carefully chip top and bottom of slab to expose rebar to minimize cutting of rebar when core drilling. Provide x-ray study before drilling or cutting where required by the Region and/or the Consultant.

3.1.24. Provide sleeves for all new conduit passing through floor and roof slabs, beams, concrete walls and slab to slab partitions, etc.

3.1.25. Where cables and conduits pass through partitions and through floors that are not fire rated, provide an air-tight seal around the cables and conduits.

3.1.26. Where cables and conduits pass through floors and fire rated walls, pack space between conduit (or cable) and sleeve with an approved fire stop as specified in Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

3.1.27. Prior to installation of any wire or cable in the ducts, pull through each duct a flexible mandrel not less than 300 mm long and size for the internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely. Notify the Consultant no less than 48 hours prior to the event, so that the Consultant may witness.

3.2. SURFACE CONDUITS

3.2.1. Run parallel or perpendicular to building lines.

3.2.2. Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

3.2.3. Run conduits in flanged portion of structural steel.

3.2.4. Group conduits wherever possible on suspended or surface mounted channels.

3.2.5. Do not pass conduits through structural members, except as indicated on the Drawings.

3.2.6. Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.2.7. Conduits must not be used to support other conduits.

3.3. CONCEALED CONDUITS

3.3.1. Run parallel or perpendicular to building lines.

3.3.2. Do not install horizontal runs in masonry walls.

3.3.3. Do not install conduits in terrazzo or concrete toppings.

3.4. CONDUITS IN CAST-IN-PLACE CONCRETE

3.4.1. Locate to suit reinforcing steel. Install in centre one third of slab.

3.4.2. Protect conduits from damage where they stub out of concrete.

3.4.3. Install sleeves where conduits pass through slab or wall.

3.4.4. Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

3.4.5. Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

3.4.6. Encase conduits completely in concrete with minimum 25 mm concrete cover.

3.4.7. Organize conduits in slab to minimize cross-overs.

3.5. CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

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

3.6. CONDUITS UNDERGROUND

3.6.1. Slope conduits to provide drainage.

3.6.2. For all non-PVC conduits run underground, provide waterproof joints with heavy coat of bituminous paint.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

1.2.1. Ontario Electrical Safety Code, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and Product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

2. Products

2.1. EQUIPMENT IDENTIFICATION

2.1.1. Identify electrical equipment with nameplates as follows:

.1 Lamacoid 3 mm thick plastic engraved sheet, black or red face, white core, mechanically attached with self-tapping screws or rivets.

.2 White letters 12 mm high for major switchboards, panelboards and power transformers.

.3 White letters 12 mm high for terminal boxes, junction boxes, grid boxes, splitter boxes, disconnect switches starters and contactors.

.4 Allow for an average of fifty (50) to one hundred (100) letters per nameplate.

.5 Identification to be in English.

.6 Black nameplates for normal power.

.7 Red nameplates for emergency power.

.8 Blue nameplates for UPS Power.

Sample:

SWITCHBOARD AA

3000A, 600/347V, 3 PH, 4W, 50kA

FED FROM SWITCHBOARD AAA

MANUFACTURED IN MM/YYYY; SERIAL NUMBER ##-####

.9 Wording on nameplates to be approved by the Consultant prior to manufacture.

.10 Nameplates for splitters, terminal cabinets, grid boxes, pull boxes, and junction boxes are to indicate the system and/or voltage characteristics.

.11 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.12 Transformers: indicate capacity, primary and secondary voltages, and upstream source where Transformer is fed from.

.13 Mechanical equipment: indicate equipment name and full circuit number including panel board identification.

.14 Switchboards, distribution panels and panelboards: Name designation, rated ampacity, voltage, number of phases, and number of wires, if neutral is rated for 200%, interrupting capacity in units of kA, upstream source from which panelboard is fed, month and year manufactured, and serial number.

.15 Provide nameplates on all electrical equipment including:

.1 Splitters, terminal cabinets, grid boxes, pull boxes, and junction boxes

.2 Disconnects, starters and contactors, and mechanical equipment

.3 Transformers

.4 Switchgear, switchboards, distribution panels, and panelboards

.5 Lighting control systems

2.1.2. Labels:

.1 A printed label, similar to a Brady label 6 mm high letters unless specified otherwise on the Drawings, for internal components, such as relays, fuses, terminal blocks.

2.2. WIRING IDENTIFICATION

2.2.1. Identify wiring with permanent legible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

2.2.2. Maintain phase sequence and colour coding throughout.

2.2.3. Colour code: in conformance with the Ontario Electrical Safety Code.

2.2.4. Use colour coded wires in communication cables and control wiring, matched throughout system.

2.3. CONDUIT AND CABLE IDENTIFICATION

2.3.1. Colour code conduits, boxes and metallic sheathed cables.

2.3.2. Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

2.3.3. Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Colour
up to 250 V Normal Power	Green
up to 600 V Normal Power	Blue
up to 250 V Emergency Power	Black
up to 600 V Emergency Power	Orange
High Voltage, greater than 750 V	Large independent label clearly identifying the voltage
Telephone/Data	White
Fire alarm	Red
Other security systems	Yellow
Controls	Purple

2.4. RECEPTACLE IDENTIFICATION

2.4.1. All receptacles including systems furniture receptacles and whip connections are to be labelled with the respective circuit numbers with a printed label, similar to a Brady label, with 12mm characters. Circuit number to include full circuit number including panel board identification.

2.4.2. Label shall be placed on wall above cover plate or on cover plate. Location of label shall be consistent throughout the project.

2.5. MANUFACTURERS AND CSA LABELS

2.5.1. Visible and legible after equipment is installed.

2.6. WARNING SIGNS

2.6.1. Provide warning signs, as specified, and/or to meet the requirements of the building/electrical safety inspectors.

2.7. FUSE SIZE LABELLING

2.7.1. The Contractor shall install a label on all equipment with fuses to identify the fuse sizes and class that are installed in the respective equipment.

2.7.2. The Contractor shall also install a label on all equipment with fuses to identify the maximum allowable fuse size based on the size of the respective feeders.

3. Execution

3.1. NOT USED

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. SHOP DRAWINGS AND PRODUCT DATA

1.2.1. Submit Shop Drawings and Product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2.2. Submit Drawings showing size, type and location of all access doors, for review by the Consultant, before installation.

2. Products

2.1. MATERIALS

2.1.1. Access doors shall be Acudor Products Inc., Mifab Inc., or Equivalent. Coordinate with other trades on Site. All access doors on Site shall be from the same manufacturer.

2.1.2. Doors in solid walls shall be equal to Acudor Model UF5000 or Equivalent with 14 U.S. gauge, prime painted steel door panel, rust resistant concealed hinges and screwdriver operated lock.

2.1.3. Doors in plaster partitions or ceiling shall be equal to Acudor model AP5010 or Equivalent 16 US gauge, prime painted steel, concealed hinges and screwdriver operated lock.

2.1.4. Doors in drywall partitions or ceiling shall be equal to Acudor model DW 5040 or Equivalent, 20 US gauge, prime painted steel, concealed hinges and screwdriver operated lock.

2.1.5. Access doors in fire rated walls or ceilings shall be equal to Acudor Model FW 5050 or Equivalent and ULC labeled with insulated door panel, concealed hinge, self-closing, self-latching, and prime painted. Provide master key operated catch in areas accessible to the public.

2.1.6. All doors in tiled walls shall be 16 US gauge, stainless steel, type 304 with #4 satin finish, concealed hinges, wall frame and screw driver operated lock.

2.1.7. Minimum size of doors shall be 300 mm x 450 mm. Wherever possible 600 mm x 600 mm doors shall be used.

3. Execution

3.1. INSTALLATION

3.1.1. All parts of the installation requiring periodic maintenance shall be accessible. Wherever pull boxes, junction boxes and other appurtenances are concealed by building construction, access doors shall be furnished by this section and installed under the respective trade sections (i.e. masonry, plaster, drywall, tile, etc.). This section is responsible for the proper location of the access doors.

3.1.2. Wherever possible, items requiring access shall be located in easily accessible areas (i.e. exposed or T-bar ceilings).

3.1.3. Group items in order to minimize the number of access doors required.

3.1.4. Each access door shall be installed to provide complete access to equipment for maintenance and servicing.

3.1.5. Make any changes to locations of access doors as directed by the Consultant.

3.1.6. The final installed locations of all access doors shall be shown on the as-built record Drawings.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. MATERIALS

2.1.1. All services and materials used for the cutting and patching shall meet all requirements specified in Section 26 05 01.00, and shall be carried out by experienced workers.

2.1.2. Include all cutting and patching for all electrical services.

3. Execution

3.1. INSTALLATION

3.1.1. Cut all openings no larger than is required for the services. Core drill for individual services.

3.1.2. Obtain approval from the Consultant before cutting or core drilling any openings or holes in slabs or structural elements.

3.1.3. Locate all openings in structure elements requiring cutting and patching, and scanning the structure to obtain the Consultant's approval prior to cutting or core drilling of existing structure. Make adjustments to location of openings as required to minimize cutting of rebar, and completely avoiding electrical conduit.

.1 Cut holes through slabs only.

.2 Do not cut holes through beams.

.3 Holes to be cut are 200 mm (Diameter) or smaller only.

.4 Maintain at least 100 mm clear from all beam faces. Space at least 3 hole diameters on Centre.

.5 For holes that are required closer than 25% of slab span from the supporting beam face, use cover meter above the slab to clear slab top bars.

.6 For holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars.

3.1.4. Scanning:

.1 Only Ground Penetrating Radar (GPR) scanning is permitted. X-ray scanning is not acceptable within the Region's facilities.

.2 Scanning shall be performed by a qualified technician, in a safe manner and in accordance with all applicable regulations governing this activity.

.3 Follow any safety requirements stipulated by the Region and/or the Consultant.

3.1.5. Patch all openings after services have been installed to match the surrounding finishes.

3.1.6. In existing areas, all cutting and core drilling for individual services, except where specifically noted on the Drawings, is part of this Division work.

3.1.7. The cost of scanning, cutting, patching and finishing is included in the Contract Price.

END OF SECTION

PART 1 – GENERAL

1.1 General

.1 The purpose of this section is to specify Division 26 responsibilities in the commissioning process.

.2 The systems to be commissioned are listed in Section 01 91 00, Part 1.9.

.3 Commissioning requires the participation of Division 26 to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 01 91 00. Division 26 shall be familiar with all parts of Section 01 91 00 and the commissioning plan issued by the CA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

.4 CA = Commissioning Agent.

1.2 Responsibilities

.1 Electrical Subcontractors. The Contractor shall ensure that the electrical Subcontractor complies with all requirements included in this Section and fulfills the following responsibilities (all references apply to commissioned equipment only):

.1 Documentation of all procedures performed shall be provided and forwarded to the Professional Engineer. Written documentation must contain recorded test values of all electrical tests performed per the individual product specification.

.2 The start-up service company shall be present during energization of the electrical equipment. Site and equipment access must be provided by the electrical Subcontractor.

.3 The Contractor shall supply a power source, specified by the start-up service company, for on-Site test equipment.

.4 The Contractor is to attend all factory witness testing required within the respective Specification Sections. The Contractor shall cover all their costs and include them in their bid.

.5 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.6 Include the cost of commissioning in the Contract Price, if not yet let.

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

.8 Attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the commissioning process.

.9 The Contractor shall provide normal cut sheets and shop drawing submittals to the CA of commissioned equipment. Provide additional requested documentation, prior to normal O&M manual submittals, to the CA for development of pre-functional and functional testing procedures.

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

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

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

.11 Contractors shall assist (along with the design Professional Engineers) in clarifying the operation and control of commissioned equipment in areas where the Specifications, control Drawings or equipment documentation is not sufficient for writing detailed testing procedures.

.12 Provide assistance to the CA in preparation of the specific functional performance test procedures specified in Section 26. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.

.13 Develop a full start-up and checkout plan using manufacturer's start-up procedures and the pre-functional test sheets from the CA. Submit manufacturer's detailed start-up procedures and the full start-up plan and procedures and other requested equipment documentation to CA for review.

.14 During the startup and checkout process, execute and document the electrical-related portions of the pre-functional test sheets provided by the CA for all commissioned equipment.

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

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

.17 Perform functional performance testing under the direction of the CA for specified equipment in 01 91 00 Section 1.9. Assist the CA in interpreting the monitoring data, as necessary.

.18 Correct deficiencies (differences between specified and observed performance) as interpreted by the CA and the Consultant and retest the equipment.

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

.20 During construction, maintain as-built red-line Drawings for all Drawings. Update after completion of commissioning (excluding deferred testing). Prepare red-line As-Built Drawings for all Drawings.

.21 Provide training of the Region's operating personnel as specified in Section 3.5.

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

.23 Execute seasonal or deferred functional performance testing, witnessed by the CA, according to the Specifications.

.24 Correct deficiencies and make necessary adjustments to O&M manuals and as-built Drawings for applicable issues identified in any seasonal testing.

PART 2- PRODUCTS

.1 NOT USED

PART 3- EXECUTION

3.1 Submittals

.1 The Contractor shall ensure that Section 26 Subcontractors provide submittal documentation relative to commissioning to the CA as requested by the CA. Refer to Section 01 91 00 Part 3.3 for additional Section 26 requirements.

3.2 Start-up of Equipment

.1 The Contractor shall ensure that the electrical Subcontractor(s) follows the start-up and initial checkout procedures listed in the Responsibilities list in this section and in Section 01 91 00, Part 3.4. Section 26 has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning authority or Region.

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

.3 All equipment shall be started by the manufacturer's representative.

3.3 Pre-Functional Test Sheets

.1 Pre-functional test sheets contain items for Section 26 Contractors to perform. On each checklist, a column is provided that is to be completed by the Contractor assigning responsibility for that line item to a Subcontractor. Those executing the test sheets are only responsible to perform items that apply to the specific application at hand. These test sheets do not take the place of the manufacturer's recommended checkout and start-up procedures or report. Some checklist procedures may be redundant in relation to checkout procedures that will be documented on typical factory field checkout sheets. Double documenting may be required in those cases.

.2 Refer to Section 01 91 00 for additional requirements regarding pre-functional test sheets, startup and initial checkout. Items that do not apply should be noted along with the reasons on the form. If this form is not used for documenting, one of similar rigor and clarity shall be used pending approval from the CA. Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their Subcontractors are completed and checked off. "Contr." column or abbreviations in brackets to the right of an item refer to the contractor responsible to verify completion of this item. A/E = Architect/Engineer, All = all Contractors, CA = Commissioning Agent, CC = Controls Contractor, EC = Electrical Contractor, PM/GC = General Contractor, MC = Mechanical Contractor, SC = Sheet Metal Contractor, TAB = Test and Balance Contractor.

3.4 Operations and Maintenance Manuals

.1 The Contractor shall ensure that the Section 26 Subcontractors compile and prepare documentation for all equipment and systems covered in Section 26 and deliver it to the Contractor for inclusion in the O&M manuals

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

3.5 Training of Region Personnel

.1 The Contractor shall coordinate and schedule training and ultimately ensure the training is completed. Refer to Section 01 91 00 for additional details.

.2 The CA will oversee and approve the content and adequacy of the training of Region personnel for commissioned equipment Refer to Section 01 91 00 for additional details.

.3 Electrical Subcontractor: The Contractor shall ensure that the electrical Subcontractor fulfills the following training responsibilities:

.1 Provide the CA with a training plan two weeks before the planned training according to the outline described in Section 01 91 00, Part 3.8.

.2 Provide designated Region personnel with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of commissioned electrical equipment or system.

.3 Training shall start with classroom sessions, if necessary, followed by hands on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.

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

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

.6 The training sessions shall follow the outline in the Table of Contents of the O&M manual and illustrate whenever possible the use of the O&M manuals for reference.

.7 Training shall include:

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

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

.3 Discuss relevant health and safety issues and concerns.

.4 Discuss warranties and guarantees.

.5 Cover common troubleshooting problems and solutions.

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

.7 Discuss any peculiarities of equipment installation or operation.

.8 Classroom sessions shall include the use of overhead projections, slides, video and audio taped material as might be appropriate.

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

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

.11 Training shall occur after functional testing is complete, unless accepted otherwise by the Consultant.

3.6 Deferred Testing

.1 Refer to Section 01 91 00, Part 3.9 for requirements of deferred testing.

3.7 WRITTEN WORK PRODUCTS

.1 Written work products of Section 26 Subcontractors will consist of the startup and initial checkout plan as described in Section 01 91 00, as well as completed startup, initial checkout and pre-functional test sheets.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.3. Section 26 05 05.00 – MOUNTING HEIGHTS.

1.1.4. Section 26 05 53.00 – IDENTIFICATION.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 29 – Panelboards and Enclosed Panelboards, latest edition.

1.2.2. CSA C22.2 No. 5 – Molded-case circuit breakers, molded-case switches and circuit-breaker enclosures, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and Product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.3.2. Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

2. Products

2.1. PANELBOARDS

2.1.1. Panelboards: Product of one manufacturer.

2.1.2. Install circuit breakers in panelboards before shipment.

2.1.3. In addition to CSA requirements manufacturer's nameplate must show fault current that the panel including all breakers have been built to withstand.

2.1.4. Panelboards to have the following minimum ratings for interrupting capacity or as indicated on the Drawings or panel schedules.

.1 120/208V panelboards – 10kA

.2 347/600V panelboards – 22kA

2.1.5. Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

2.1.6. Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated. Provide an additional 20% of space within each panelboard in addition to what is shown on the Drawings when a separate panel schedule is not provided for a specific panelboard.

2.1.7. Two keys for each panelboard and key panelboards alike.

2.1.8. Panelboards to be copper bus unless identified otherwise on the Drawings.

2.1.9. Where identified on the Drawings or schedules, provide a copper neutral bus sized to 200% of the mains rating for panels.

2.1.10. Mains: suitable for bolt-on breakers.

2.1.11. Trim with concealed front bolts and hinges.

2.1.12. Trim and door finish: baked grey enamel.

2.1.13. Enclosure to be CSA Type 2 sprinkler proof.

2.1.14. Surge protection device as required.

2.1.15. Series ratings may be acceptable. Panels to be labeled as such. Manufacturing to supply supporting data.

2.2. MOULDED CASE CIRCUIT BREAKERS

2.2.1. Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg. C. ambient.

2.2.2. Common-trip breakers: with single handle for multi-pole applications.

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

2.2.4. Main breaker, where indicated on the panel schedules: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

2.2.5. Lock-on devices for 10 % of 15 to 30 A breakers installed. Turn over unused lock-on devices to Owner.

2.2.6. Where breakers are identified to feed high intensity discharge (HID) lighting, provide breakers that are rated and designed for use with HID lighting.

2.2.7. Provide one breaker per designated breaker space. Multiple breakers contained in one housing or twin breakers are not acceptable.

2.3. EQUIPMENT IDENTIFICATION

2.3.1. Provide equipment identification in accordance with Section 26 05 53.00 – IDENTIFICATION.

2.3.2. Complete circuit directory with typewritten legend showing location and load of each circuit.

2.4. MANUFACTURERS

2.4.1. The following are acceptable manufacturers:

.1 Schneider Electric Inc.

.2 Eaton Corporation Inc.

.3 Siemens Electric Ltd.

.4 Or Equivalent

3. Execution

3.1. INSTALLATION

3.1.1. Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

3.1.2. Install surface mounted panelboards on galvanized unistrut stand-offs or on fire rated plywood backboards. The plywood backboards are to be as per Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

3.1.3. Mount panelboards at height specified in Section 26 05 05.00 – MOUNTING HEIGHTS.

3.1.4. Connect loads to circuits.

3.1.5. Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.3. Section 26 05 05.00 – MOUNTING HEIGHTS.

1.1.4. Section 26 05 53.00 – IDENTIFICATION.

1.1.5. Section 26 51 13.00 – LIGHTING EQUIPMENT.

1.2. SHOP DRAWINGS AND PRODUCT DATA

1.2.1. Submit shop drawings and Product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

2. Products

2.1. SWITCHES

2.1.1. 20 A, single pole, double pole, three-way, or four-way specification grade switches. Voltage rating of the switch to be as per the Contract Documents.

2.1.2. Manually-operated general purpose switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Decora style specification grade rocker switch.

.6 Colour will be selected by the Consultant.

2.1.3. Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

2.2. RECEPTACLES

2.2.1. All receptacles shall be Specification grade.

2.2.2. Duplex Specification receptacles, Decora style CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 Thermoplastic with impact-resistant nylon face moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Eight back wired entrances, four side wiring screws.

.4 Triple wipe contacts and riveted grounding contacts.

2.2.3. Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Thermoplastic moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Four back wired entrances, 2 side wiring screws.

2.2.4. Other receptacles with ampacity and voltage as indicated.

2.2.5. Receptacles shall be coloured as follows:

.1 Normal Power – Colour will be selected by the Consultant.

.2 Emergency/Essential Power – Red.

.3 Isolated Ground – Orange.

.4 Switched – Gray.

.5 UPS – Blue.

2.2.6. All dwelling receptacles of CSA configuration 5-15R and 5-20R shall be tamper resistant receptacles and shall be so marked; receptacles dedicated for microwaves, refrigerators, freezers or those receptacles located in an attic or crawl space shall not be tamper-resistant.

2.2.7. The Contractor shall ensure that the electrical Subcontractor coordinates with the furniture supplier to identify switched circuits prior to installation.

2.3. MANUFACTURERS

2.3.1. The switches and wiring devices shall be of one manufacturer throughout the project.

2.3.2. The following are acceptable manufacturers, or as per the Specification on electrical design Drawings:

.1 Legrand Inc.

.2 Hubbell Inc.

.3 Eaton Corporation Inc.

.4 Leviton Manufacturing Company Inc.

.5 Or Equivalent.

2.4. DIMMERS

2.4.1. Dimmers shall be 600W, 1500W, 2000W.

.1 Full range, continuously variable control of light intensity.

.2 Vertical slider allowing the light level to be set by the user.

.3 Slide to Off.

.4 Capable of operating at rated capacity.

.5 Power failure memory.

.6 Dimmers shall be available for direct control of incandescent, magnetic low voltage, electronic low voltage, fluorescent, and LED.

2.4.2. Incandescent dimmers.

.1 Direct control of up to a full 20A lighting circuit.

2.4.3. Electronic (solid-state) Low Voltage (ELV) transformer dimmers (incandescent).

.1 Circuitry designed to control the input of Electronic (solid state) Low Voltage transformers.

.2 Control up to 600W of Electronic Low Voltage load.

.3 Reset-able overload protection when capacity is exceeded.

2.4.4. Magnetic Low-Voltage (MLV) transformer dimmers.

.1 Designed to control and provide a symmetrical AC wave form to input of magnetic low voltage transformers per UL 1972 section 5.11.

.2 Direct control of up to 1500VA of Magnetic Low Voltage load.

.3 Dimmer shall be suitable to control dimming ballast as specified in Section 26 51 13.00 – LIGHTING EQUIPMENT.

2.4.5. LED dimmers.

.1 Slide to Off only. Must match driver and LED requirements.

2.4.6. Manufacturers

.1 Lutron Electronics Inc.

.2 Legrand Inc.

.3 Or Equivalent.

2.5. SPECIAL WIRING DEVICES

2.5.1. Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic lens flush type.

2.6. COVER PLATES

2.6.1. Cover plates for wiring devices.

2.6.2. Cover plates from one manufacturer throughout project.

2.6.3. Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

2.6.4. Provide cover plates, suitable for the respective device, for all devices mounted in flush-mounted outlet boxes located in finished areas.

2.6.5. Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

2.6.6. Weatherproof rain tight while-in-use metal cover, complete with gaskets for duplex receptacles located outside or as indicated on the Drawings.

2.6.7. Weatherproof rain tight while-in-use metal cover, complete with gaskets for single receptacles or switches located outside or as indicated on the Drawings.

3. Execution

3.1. INSTALLATION

3.1.1. 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 toggle switches at height specified in Section 26 05 05.00 – MOUNTING HEIGHTS or as indicated on the Drawings.

3.1.2. Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height specified in Section 26 05 05.00 – MOUNTING HEIGHTS or as indicated on the Drawings.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

3.1.3. Dimmers:

.1 Install dimmers as indicated on the Drawings. Provide suitable clearances in multi-gang boxes as recommended by the manufacturer to maintain the dimmer rating.

.2 Coordinate the dimmer selection with the ballast/driver to be controlled, to ensure compatibility.

3.1.4. Cover plates:

.1 Provide white cover plates unless otherwise noted on the electrical or architectural design Drawings.

.2 Protect cover plate finish with paper or plastic film until painting and other Work is finished.

.3 Install suitable common cover plates where wiring devices are grouped.

.4 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.1.5. Labelling

.1 Provide labels with panel name and circuit number on all receptacles in conformance with Section 26 05 53.00 – IDENTIFICATION.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 248-00 – Low Voltage Fuses.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and Product data in accordance with Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.3.2. Submit fuse performance data characteristics for each fuse type and size above 100 A. Performance data to include: average melting time-current characteristics, I2t (for fuse coordination), and peak let-through current.

1.4. MAINTENANCE MATERIALS

1.4.1. Three spare fuses of each type and size installed 600 A and above.

1.4.2. Six spare fuses of each type and size installed up to and including 400 A.

1.5. DELIVERY AND STORAGE

1.5.1. Ship fuses in original containers.

1.5.2. Do not ship fuses installed in switchboard.

1.5.3. Store fuses in original containers in moisture free location.

2. Products

2.1. FUSES GENERAL

2.1.1. Fuse type references L1, L2, J1, etc. have been adopted for use in this Specification.

2.1.2. Fuses: Product of one manufacturer.

2.1.3. Fuses to have an indicating window to identify when the fuse has been blown.

2.2. FUSE TYPES

2.2.1. Class L fuses.

.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type L2, fast acting.

2.2.2. Class J fuses.

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.2 Type J2, fast acting.

2.2.3. Class C fuses.

2.2.4. Fuses for Motors:

.1 All fuses for motor loads are to be time-delay type.

2.3. MANUFACTURERS

2.3.1. The following are acceptable manufacturers:

.1 Eaton Corporation Inc.

.2 Ferraz Shawmutt Inc.

.3 Littelfuse Inc.

.4 Or Equivalent

3. Execution

3.1. INSTALLATION

3.1.1. Install fuses in mounting devices immediately before energizing circuit.

3.1.2. Ensure correct fuses fitted to assigned electrical circuit.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 5 – Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and Product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS

1.3.2. Include time-current characteristic curves for breakers with ampacity of 400A and over or with interrupting capacity of 22,000 A symmetrical (RMS) and over at system voltage.

1.3.3. The Contractor shall visit the Site and confirm the new breakers used are compatible with the existing electrical panels.

2. Products

2.1. BREAKERS GENERAL

2.1.1. Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg. C. ambient.

2.1.2. Common-trip breakers: with single handle for multi-pole applications.

2.1.3. Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

2.1.4. Circuit breakers with interchangeable trips as indicated on the Drawings.

2.2. THERMAL MAGNETIC BREAKERS

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

2.3. MAGNETIC BREAKERS

2.3.1. Moulded case circuit breakers to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4. FUSED THERMAL MAGNETIC BREAKERS

2.4.1. Fused thermal magnetic breakers with current limiting fuses internally mounted. Time current limiting characteristics of fuses coordinated with time current tripping characteristics of circuit breaker. Coordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker. Fuses individually removable and interlocked with breaker. The removal of fuse cover, blowing of a fuse or removal of a fuse, shall trip the breaker.

2.5. SOLID STATE TRIP BREAKERS

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

2.6. ACCESSORIES

2.6.1. Include:

.1 shunt trip, when electrically operated or when indicated on the Drawings.

.2 auxiliary switches, when electrically operated or when indicated on the Drawings.

.3 motor-operated mechanism, when electrical operation indicated on the Drawings.

.4 on-off locking device.

.5 handle mechanism.

2.7. MANUFACTURERS

2.7.1. The following are acceptable manufacturers:

.1 Schneider Electric Inc.

.2 Eaton Corporation Inc.

.3 Siemens Electric Ltd.

.4 Or Equivalent

3. Execution

3.1. INSTALLATION

3.1.1. Install circuit breakers as indicated on the Drawings and electrical panel schedules.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. REFERENCE

1.2.1. CSA C22.2 No. 4 – Enclosed Switches.

1.2.2. CSA C22.2 No. 39 – Fuseholder Assemblies.

1.3. PRODUCT DATA

1.3.1. Submit Product data in accordance with Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2. Products

2.1. DISCONNECT SWITCHES

2.1.1. Fusible or non-fusible, horsepower rated disconnect switch in CSA Enclosure 2 sprinkler proof, size as indicated on the Drawings.

2.1.2. Provision for padlocking in on-off switch position by three locks.

2.1.3. Mechanically interlocked door to prevent opening when handle in ON position.

2.1.4. Fuses: size as indicated, class J, current limiting, in accordance with Section 26 28 14.00 – FUSES - LOW VOLTAGE.

2.1.5. Fuseholders: suitable without adaptors, for type and size of fuse indicated on the Drawings.

2.1.6. Quick-make, quick-break action.

2.1.7. ON-OFF switch position indication on switch enclosure cover.

2.2. EQUIPMENT IDENTIFICATION

2.2.1. Provide equipment identification in accordance with Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2.2.2. Indicate name of load controlled on nameplate.

2.2.3. Provide a lamacoid that indicates the replacement fuse size as well as the maximum allowable fuse size for that disconnect based upon the sizing of the feeder.

2.3. MANUFACTURERS

2.3.1. The following are acceptable manufacturers

.1 Schneider Electric Inc.

.2 Eaton Corporation Inc.

.3 Siemens Electric Ltd.

.4 Or Equivalent

3. Execution

3.1. INSTALLATION

3.1.1. Install disconnect switches complete with fuses if applicable.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS – SHOP DRAWINGS.

1.1.3. Section 26 05 21.00 – WIRES AND CABLES 1000V.

1.2. REFERENCES

1.2.1. CSA C22.2 No. 74 – Equipment for Use with Electric Discharge Lamps, latest edition.

1.2.2. The Consortium of Energy Efficiency (CEE) guidelines, latest edition.

1.2.3. IESNA LM-79 – Approved Method: Electric and Photometric Measurements of Solid-State Lighting Products, latest edition.

1.2.4. IESNA LM-80 – Approved Method: Measuring Lumen Maintenance of LED Light Sources, latest edition.

1.2.5. The Certified Ballast Manufacturers Association (CBM) standards, latest edition.

1.2.6. NEMA 410 – Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts, latest edition.

1.3. SUBSTITUTION

1.3.1. The lighting equipment for this project and specified herein has been carefully selected for its ability to meet the project's luminous environment requirements. Manual and computer calculations have been performed to ensure that the lighting equipment that has been specified complies with established criteria. If alternates or substitutions are proposed by the Contractor, then it is the responsibility of the Contractor to provide all information required herein and detailed layouts and lighting calculations demonstrating that the performance of the alternate luminaire meets or exceeds the original lighting design while not consuming any additional energy. The Contractor is responsible to ensure the light levels provided in the alternate submittal package will achieve the design light levels. Where the light levels are not achieved, the Contractor is responsible to replace the luminaire with a luminaire that will meet the required levels with no increase in energy use at no additional cost to the Region. Rather than replacing the luminaires, the Consultant may accept the installation of additional luminaires by the Contractor at no additional cost to the Region in order to achieve the required light levels.

1.3.2. Accompanying the request for a luminaire or lamp substitution, the Contractor shall submit a complete lighting calculation report with photometric modeling of the space showing light levels including average, maximum, minimum and max to min values.

1.4. SHOP DRAWING AND PRODUCT DATA

1.4.1. Submit Shop Drawings and Product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.4.2. Submit a Shop Drawing for each luminaire specified, including lamp.

1.4.3. Luminaire submittals are to consist of a physical description, manufacturer's specification sheets, dimensioned drawings, and complete photometric data from an independent test laboratory in the form of IES computer files of the equipment being submitted and hard copy of the photometric report. Coordinate ceiling types to ensure proper supports and luminaire framing.

1.4.4. Lamp submittals are to consist of manufacturer's technical data with respective luminaire Shop Drawing. Submittal to include operating wattage, rated life, colour temperature, base type, lamp shape, CRI, voltage and mercury content.

1.4.5. LED submittals are to consist of manufacturer's technical data for diodes and drivers with respective luminaire Shop Drawing. Submittal to include operating wattage, voltage, maximum distance from drivers, wiring diagrams and lumen output at time of delivery. LED Drivers must have a 50,000 hours warranty.

1.4.6. Ballast submittals are to consist of manufacturer's technical data with respective luminaire Shop Drawing. Submittal to include operating wattage, input voltage, ballast efficiency, maximum distance for remote ballasts, power factor, and operating temperature.

1.4.7. Where samples are indicated on the luminaire schedule, they are to be provided with Shop Drawings at time of Shop Drawing submittals unless noted otherwise on the Drawings.

1.5. FIXED PER UNIT COST LUMINAIRES

1.5.1. Listed in the Luminaire Schedule are a fixed per unit cost for certain luminaire types. The Contractor shall complete a take-off of the Drawings to determine quantity of each luminaire type and use the listed fixed unit price to calculate the total cost per luminaire type. The total cost for all luminaires shall be included in the Contract Price. Provide a breakdown of the total cost, per luminaire type, that is included in the electrical Work of this Contract. All luminaires shall be included in the electrical Work of this Contract including all luminaires identified with fixed unit costs. The Contractor shall include fixed per unit cost luminaires in Light Fixtures – Materials in the standard progress draw breakdown defined in Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.5.2. The fixed per unit cost excludes applicable taxes and includes lamps and distributor markups. The Contractor is responsible to include in the Contract Price for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all fixed per unit cost luminaires. Show the applicable taxes as a separate line item.

1.6. WARRANTY

1.6.1. The manufacturer shall provide a two-year warranty against defects in material and workmanship for 24 months after initial start-up.

1.6.2. LEDs, drivers, lamps and ballasts showing signs of premature failure shall be replaced at no additional cost to the Region.

2. Product

2.1. GENERAL

2.1.1. All products must be CSA or CUL approved.

2.2. LAMPS AND LEDS

2.2.1. All lamps shall meet the standards of the Consortium of Energy Efficiency (CEE) guidelines.

2.2.2. Refer to the Luminaire Schedule for project specific details, and lamps required.

2.2.3. Incandescent, tungsten halogen, high intensity discharge, compact fluorescent and linear fluorescent lamps shall be manufactured by Osram Sylvania Inc., General Electric Company, Philips Ltd., Venture, or equivalent, unless indicated otherwise on the Luminaire Schedule. Lamps shall be in accordance with the lamp Specifications detailed in the Luminaire Schedule and as noted below. The Luminaire Schedule shall take precedence where differences occur.

2.2.4. All lamps shall be new and from the same manufacturing batch to avoid colour differences. Replace all lamps that exhibit colour shift, or exhibit premature lumen intensity decline, at no additional cost to the Region.

2.2.5. Light Emitting Diodes (LED)

.1 LEDs shall meet the standards of IESNA LM-79 and LM-80.

.2 All LED drivers shall be tested and comply with the maximum in-rush current limits as stated in NEMA 410.

.3 LED's shall be manufactured by the manufacturers as indicated in the Luminaire Schedule on the Drawings, or equivalent. Colour temperature shall be as indicated on the Luminaire Schedule. Lamps shall be binned with no visible colour variance (3100K to 3300K maximum range). Rated life for 1 watt white LED shall be 50,000 hours. Lumen output shall be the maximum based on latest technology at time of delivery.

.4 All LED luminaires that present signs of failure on Site, within the warranty period, must be replaced at no additional cost to the Region. If temporary luminaires are required to replace any failed LED luminaires, during the waiting time for parts (i.e. drivers, boards, heat sinks, etc.), the labour cost including installation, temporary luminaire supply, temporary luminaire removal and reinstallation of the LED luminaire must be provided at no additional cost of the Region. Additional electrical costs, associated with higher Wattage temporary luminaires, must be reimbursed with interest to the Region by the Contractor.

.5 In case of failure of an LED luminaire, complete or part thereof, an independent third party testing Laboratory (approved by the Consultant) shall be commissioned by the manufacturer or vendor to perform tests on samples taken from the failed luminaires installed on corresponding site. All reporting including the test results must be submitted to the Consultant for evaluation and final approval.

.6 Any additional time involved by the Consultant will be billed at our hourly rates to the manufacturer or vendor.

2.3. DRIVERS

2.3.1. All drivers shall be tested and comply with maximum in-rush current limits within NEMA 410 standards. This shall be clearly indicated on Shop Drawing submittal.

2.3.2. LED dimming shall be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming shall be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.

2.3.3. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.

2.3.4. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.

2.3.5. No visible change in light output with a variation of plus/minus 10 percent line voltage input.

2.3.6. Total Harmonic Distortion less than 20% percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD.

2.3.7. Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:

.1 Adjustment of forward LED voltage, supporting 3V through 55V.

.2 Adjustment of LED current from 200mA to 1.05A at the 100 percent control input point in increments of 1mA

.3 Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.

2.3.8. Driver must be able to operate for a (+/- 10%)supply voltage of 120V through 277VAC at 60Hz.

2.3.9. Driver should be UL recognized under the component program and shall be modular for simple field replacement. Drivers that are not UL recognized or not suited for field replacement will not be considered.

2.3.10. Driver shall include ability to provide no light output when the analog control signal drops below 0.5 V, or the DALI/DMX digital signal calls for light to be extinguished and shall consume 0.5 watts or less in this standby. Control deadband between 0.5V and 0.65V shall be included to allow for voltage variation of incoming signal without causing noticeable variation in fixture to fixture output.

2.3.11. Over the entire range of available drive currents, driver shall provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0% relative light output, or 100 – 1% light output and step to 0% where indicated on the Drawings. Driver shall respond similarly when raising from 0% to 100%

.1 Driver must be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.

2.3.12. Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels

2.3.13. Drivers to track evenly across multiple fixtures at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range.

2.3.14. Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-0.1 percent luminaire shall have:

.1 LED dimming driver shall provide continuous step-free, flicker free dimming similar to incandescent source.

.2 Base specification: Flicker index shall less than 5% at all frequencies below 1000 Hz.

.3 Preferred specification: Flicker index shall be equal to incandescent, less than 1% at all frequencies below 1000 Hz.

2.3.15. Control Input

.1 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers

.1 Must meet IEC 60929 Annex E for General White Lighting LED drivers

.2 Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.

2.3.16. Must meet ESTA E1.3 for RGBW LED drivers

2.4. BALLASTS

2.4.1. All Ballasts shall comply with CSA C22.2 No. 74 and are to meet or exceed the standards of the Certified Ballast Manufacturers Association (CBM).

2.4.2. All ballasts shall be tested and comply with maximum in-rush current limits as stated in NEMA 410.

2.4.3. Not all ballasts could be used, refer to the Luminaire Schedule for project specific details.

2.4.4. All ballasts shall be manufactured by Osram Sylvania Inc., Philips Ltd., General Electric Company, Lutron Electronics Inc., Magnetek Inc., or equivalent, unless indicated otherwise on the Drawings. Ballasts shall operate at voltage and control lamps as noted in the Luminaire Schedule.

2.4.5. Ballasts for T8 lamps will be programmed rapid start, will start at minimum 0 deg. C. (indoors) and minus 29 deg. C. (outdoors). Ballasts shall meet ANSI C62.41 Category A transient voltage protection requirements. PF shall be greater than .95, and shall meet FCC Class A specifications for EMI/RFI. The maximum case temperature will not exceed 70 deg. C.

2.4.6. Ballasts for compact fluorescent lamps shall be universal input type electronic with end-of-lamp sensing. PF shall be greater than .98, BF shall be greater than .98, THD < 10%. Ballasts shall meet FCC Class A specifications for EMI/RFI.

2.4.7. Ballasts for HID lamps will be suitable for operation in 40 deg. C. temperatures, with a minimum starting temperature of minus 30 deg. C. at 90 % of line voltage. They shall be encapsulated in a steel enclosure. Insulation shall be Class H (minimum 180 deg. C.) vacuum impregnated with silica filled polyester compound. Coils shall be precision or bobbin wound. Sound rating shall be minimum class B. Continuous operation for 60,000 hours at maximum rated load and temperature. Ballast factor of 1.0, .95 minimum power factor, 1.8 minimum crest factor.

2.4.8. Electronic dimming ballasts for T8 lamped fluorescent luminaires shall be compatible with lamp type and quantity and shall meet the following requirements:

.1 Dimming range from 100% to 1% illuminance level with continuous, flicker free output with ambient noise level ≤ 27dB over the entire dimming range.

.2 Maximum lead length from ballast to lamp socket is seven feet for T-8 lamps, and 3 feet for T-5 lamps.

.3 PF > .95.

.4 BF ≥ .85.

.5 THD < 10% at full light output.

.6 Lamp crest factor ≤ 1.6.

.7 Inrush current shall be internally limited to not exceed 3 amps at 347V or 7A at 120V.

.8 Preheating of lamp cathodes before applying arc voltage.

.9 Withstand 4000V surges as per ANSI C62.41.

.10 Improper line voltage and control wiring shall not damage ballast. Each ballast shall be tested at low, medium and high end of range by manufacturer.

.11 Meet FCC Class A specifications for EMI/RFI.

2.4.9. Electronic dimming ballasts for compact fluorescent luminaires shall be compatible with lamp type and quantity and shall meet the following requirements:

.1 Dimming range from 100% to 1% illuminance level with continuous, flicker free output over the entire dimming range.

.2 Maximum lead length from ballast to lamp socket is 3 feet.

.3 PF > .95.

.4 BF ≥ .93.

.5 THD < 10% at full light output.

.6 Lamp crest factor ≤ 1.6.

.7 Inrush current shall be internally limited to not exceed 3 amps at 120V.

.8 Preheating of lamp cathodes before applying arc voltage.

.9 Withstand surges as per ANSI C62.41.

.10 Improper line voltage and control wiring shall not damage ballast. Each ballast shall be tested at low, medium and high end of range by manufacturer.

.11 Meet FCC Class A specifications for EMI/RFI.

.12 Minimum starting temperature of 10 deg. C.

2.4.10. Ballasts shall contain no PCB's and audible rating will be class A or better.

2.4.11. Racks shall be provided for remote ballasts.

2.4.12. Ballasts with unacceptable noise levels shall be replaced at no additional cost to the Region.

2.5. LUMINAIRES

2.5.1. All luminaires shall be complete with mounting brackets, transformers, supports, trims, louvers, lenses and other accessories as required to make luminaire operational and allow it to be installed in the respective location.

2.5.2. Luminaires shall be suitable for the environment where installed, include seals and gaskets, and corrosion resistant baked-on finish as required and as specified.

2.5.3. Louvers, lenses and diffusers must be of suitable thickness to prevent sagging.

2.5.4. Where the Drawings show luminaires mounted end-to-end, luminaires shall be suitable for continuous, seamless and tandem mounting.

2.5.5. Fluorescent luminaires designed for continuous, seamless and tandem mounting shall only be constructed with four foot lamps. Two and three foot lamps are not acceptable unless indicated on the Drawings or the Luminaire Schedule.

2.5.6. All poles are to come complete with internal vibration dampeners to accommodate wind conditions to avoid damage due to wind-induced vibrations.

2.5.7. All concrete bases for poles and bollards shall be designed to accommodate the height, weight, etc. of the pole/bollard and its accessories for the soil conditions for which it is installed. Engineered Shop Drawings shall be provided that is signed by a Professional Engineer.

2.5.8. Where cameras are shown to be installed on poles, the poles shall be stiffened to reduce vibration and sway, and shall be rated for video recording cameras.

2.5.9. The supply and installation of luminaires shall comply with all standards set forth in electrical Specifications. The Contractor shall include in the Contract Price all costs for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all luminaires.

2.5.10. The following is a list of generic type designation for luminaires. The Luminaire Schedule shall be referenced for the specific types and designations and the respective specifications.

.1 Designations beginning with the letter 'C' denote compact fluorescent type.

.2 Designations beginning with the letter 'D' denote incandescent or halogen type.

.3 Designations beginning with the letter 'F' denote fluorescent type.

.4 Designations beginning with the letter 'H' denote high intensity discharge type.

.5 Designations beginning with the letter 'L' denote LED type.

.6 Designations beginning with the letter 'J' denote Induction type.

.7 Designations beginning with the letter 'X' denote exit sign.

3. Execution

3.1. INSTALLATION

3.1.1. The Contractor shall obtain the information related to the luminaire and luminaire trim finishes/colours from the Consultant prior to the fabrication of luminaires. The Contractor shall provide adequate time for the design team to review and comment on luminaire and luminaire trim finishes

3.1.2. The Contractor shall provide, receive, unload, uncrate, store, protect and install lamps, luminaires, and other related lighting equipment as specified herein. Lamps for all equipment will be provided and installed by the Contractor in accordance with the equipment manufacturer's instructions.

3.1.3. Install remote ballasts in racks and wire luminaires to ballasts in conduit. Provide wiring as per manufacturer's recommendations.

3.1.4. Locate luminaires in accordance with the Drawings. Coordinate exact locations on Site. Refer to Drawings for dimensions of coves and valences. Fluorescent staggered coves must have a minimum of two inches overlap.

3.1.5. Install in accordance with manufacturer's instructions, local codes, electrical Division Drawings and Specifications.

3.1.6. All suspended luminaires shall have cables and support stems vertically aligned.

3.1.7. Suspend luminaires in mechanical rooms after all the mechanical equipment and ductwork are installed. Luminaires shall not be suspended from mechanical pipes, ductwork or other building services.

3.1.8. All luminaires shall be installed underneath other services located within ceiling space. The Contractor shall interference Drawings to ensure all services in ceiling are coordinated.

3.1.9. Any dimensions provided in the Drawings or schedules are intended as general guidelines. For exact dimensioning, refer to the architectural Drawings. The detailed information shall be cross referenced with the electrical Specifications and the Luminaire Schedule applying the most stringent requirement.

3.1.10. The Contractor shall coordinate luminaire trims and mounting system with ceiling finishes. Luminaires delivered on Site with the wrong ceiling mounting system shall be replaced without any additional cost to the Region. Restocking fees will not be accepted.

3.1.11. For suspended ceiling installations, support luminaires from structural slab in accordance with local inspection requirements.

3.1.12. Where luminaires are mounted in tandem, align luminaires mounted in continuous rows to form straight uninterrupted line.

3.1.13. Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.1.14. Ensure light leakage does not occur from openings and trim rings. The Contractor shall repair the ceiling at no additional cost to the Region if cut-out is too large.

3.1.15. Connect luminaires to lighting circuits.

3.1.16. Provide all wiring in conduit with junction boxes on a grid pattern to limit the run of flexible armoured cable drops from the ceiling mounted junction box to each luminaire to a maximum of 3 m in length unless approved otherwise in writing by the Consultant.

3.1.17. Modular wiring systems shall be employed only where indicated in the Drawings or with approval of the Consultant.

3.1.18. Luminaires shall not be used as temporary construction lighting. After being tested to ensure acceptable operation, luminaires will not be used until Substantial Completion of the Contract unless permission is received from the Region or the Consultant.

3.1.19. Lamps shall be installed after luminaire is cleaned. All fluorescent lamps shall be run through a minimum of 12 hours initial start to increase the lamp life and all lamps shall be run through a minimum of 100 hours initial start prior to any dimming.

3.1.20. Clean all luminaires, inside and out at time of Substantial Performance of the Contract. Replace all scratched or damaged luminaires, lenses, louvers and diffusers at no additional cost to the Region.

3.1.21. Installation of exit signs

.1 Rough-in and installation of exit signs shall be carefully coordinated on Site such that after installation of all equipment/services, including equipment/services from other trades (i.e. sprinkler lines, plumbing pipes, way-finding signs, etc.), shall not interfere with the line-of-sight visibility of the exit sign(s) from approach of the intended egress pathway(s).

.2 If exit sign(s) have been installed and do not meet the satisfaction of the Consultant, the Contractor shall lower, raise or relocate the exit sign(s) such that proper and adequate visibility of the exit sign(s) is achieved at no additional cost to the Region.

END OF SECTION

1. General

1.1. OVERVIEW

1.1.1. Read and comply with all sections of the Contract Documents.

1.1.2. All Drawings and general provisions of the Contract, including all General Conditions, Division 1 Specification Sections and Instructions to Bidders apply to this section and all other Specification sections.

1.1.3. Provide all labour, materials, tools, and equipment required for the complete installation of work called for in all sections of the Contract Documents.

1.2. WORK INCLUDED

1.2.1. The Contractor shall ensure the Cabling Subcontractor provides new telecommunications structured cabling systems for the area included in the scope of this project. The structured cabling systems shall be as follows:

.1 Horizontal structured cabling system consisting of 4-pair copper cabling for telephony & data applications.

.2 Intra-building backbone structured cabling system consisting of multipair copper cabling.

.3 Intra-building backbone structured cabling system consisting fibre optic cabling.

1.2.2. All horizontal cabling will be serviced from the nearest logical Telecommunications Room, either existing or new as shown on floor plans on the Drawings.

1.2.3. The Telecommunications Structured Cabling system shall be based on a physical star wiring topology (unless otherwise specified in the Contract Documents) that is designed in accordance with and supported by a manufacturer backed certification and warranty as specified herein. This cabling infrastructure solution shall encompass, and not be limited to, all telecommunication outlets, cable, cable terminating hardware, equipment cabinets/racks and selected connectivity devices.

1.2.4. All exposed components of the Telecommunications cabling system that is to be located within mechanical spaces deemed to be a Return Air Plenum must have a CMP (FT6) rating. CMR (FT4) rated components may be used in mechanical spaces pending approval by all Authorities Having Jurisdiction (AHJ) and/or the Communications Consultant. For this project, all components shall have a CMP (FT6) rating unless otherwise specified in this document. All CMP (FT6) rated products must be CSA/ULC approved.

1.2.5. While every attempt has been made to ensure all information is correct at the time of publication, the products specified are available and any part numbers identified are correct, the Contractor through its Cabling Subcontractor shall verify all part numbers and report any errors and/or omissions in this Specification to the Region if discovered during the tendering period and to the Consultant if discovered after Contract award..

1.2.6. Dimensions shown on Drawings are approximate. Verify dimensions by reference to Shop Drawings and field measurements.

1.2.7. Quantities or lengths indicated in any of the Contract Documents are approximate only and shall not be held to gauge or limit the work.

1.2.8. Include in total bid price all labour, materials, plant, transportation, storage costs, training, equipment, insurance, temporary protection, permits, inspections, bonding, taxes and all

necessary and related items required to provide complete and operational systems shown and described in the Contract Documents.

1.3. CONTRACT DOCUMENTS

1.3.1. The Contractor must read and comply with all requirements as stated in Divisions 0 and 1. In the event of a conflict between Divisions 0/1 sections and information contained in sections 27 00 05.10 - General Instructions, 27 00 05.60 – Administrative Requirements and 27 00 05.70 – Project Specific Requirements, Divisions 0 and 1 shall have precedence.

1.4. SCHEDULE

The Contractor shall ensure the Cabling Subcontractor meets and adheres to all project milestones as indicated in the project schedule(s).

1.4.1. The Contractor acknowledges that project schedule(s) are subject to change. The Contractor shall verify with the Consultant and Cabling Subcontractor all project milestones.

1.5. LABOUR

1.5.1. The Contractor shall ensure the Cabling Subcontractor complies with all job-site requirements for the duration of the project.

1.5.2. The Contractor and its Cabling Subcontractor as listed by the Contractor in the Schedule of Subcontractors in the Bid Form shall not assign or sub-contract any work without the prior written consent of the Region. Refer to GC 10 – Subcontractors of the General Conditions for additional requirements.

1.5.3. The Contractor shall ensure the Cabling Subcontractor uses only tradesmen who are fully trained, qualified and experienced on the installation, termination and testing of the Structured Cabling Solution.

1.5.4. Third party certification will not be permitted unless the certifying contractor performs the termination and testing for all cabling.

1.5.5. The Contractor shall ensure the Cabling Subcontractor shall make any changes or alterations required by an authorized inspector of the Authority Having Jurisdiction.

1.5.6. The Contractor shall ensure the Cabling Subcontractor obtain consent from the Contractor’s project manager before changing the Cabling Subcontractor’s project manager and/or project foreman during the project.

1.6. ACCESS AND PROTECTION

1.6.1. Access to the Site shall be limited to location and time of day specified in the Supplementary Conditions of the Contract. Refer to Section 27 00 05.70 and conform to requirements.

1.7. DRAWINGS, CHANGES AND INSTALLATION

1.7.1. The Drawings are intended to show the general character and scope of the work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operative installation.

1.7.2. The location, arrangement and connection of equipment and material as shown on the Drawings represent a close approximation to the intent and requirements of the Contract. The Consultant or Region acting reasonably may make changes required to accommodate conditions arising during the progress of the work, at no extra cost to the Region.

1.7.3. Certain details indicated on the Drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details shall be applicable to every occurrence on the Drawings.

1.7.4. The location and size of existing services shown on the Drawings are based on the best available information. The Contractor shall ensure the Cabling Subcontractor will verify the actual location of existing services in the field before work is commenced.

1.7.5. Changes and modifications necessary to ensure co-ordination and to avoid interference and conflicts with other trades, or to accommodate existing conditions, shall be made at no extra cost to the Region.

1.7.6. Leave areas clear where space is indicated as reserved for future equipment, and equipment for other trades. Adequate space and provisions shall be left for removal of components and servicing of equipment, with minimum inconvenience to the operation of systems.

1.7.7. Where equipment is shown on the Drawings to be 'roughed in only' obtain accurate information from the Consultant before proceeding with the work.

1.7.8. Location of outlets, luminaires, diffusers, grilles, registers, thermostats, sprinklers and all other equipment shown on Drawings (is diagrammatic.

1.7.9. The Contractor, at its expense, shall remedy any work not installed in correct location (at the sole discretion of Consultant). The Contractor shall ensure the Cabling Subcontractor is will mark-out its work and fully co-ordinate with all other trades. Review with Consultant prior to rough in. Prepare dimensioned layouts of each room prior to rough in for review by Communications Consultant. Do not proceed with any work until the Communications Consultant has reviewed and approved the layout Drawings.

1.8. SUBSTITUTIONS & ALTERNATE PRODUCTS

1.8.1. The Contract Documents specify the use of a complete end to end Structured Cabling Solution as manufactured, warranted and certified by the same manufacturer. Alternate materials (from the overall cabling solution) will not be accepted unless specifically noted in the Contract Documents.

1.8.2. Where supply of the materials may compromise the schedule, the Contractor shall submit a request to use alternate product to the Consultant. Depending on the circumstance, the Consultant may provide written authorisation to substitute the Product. Written authorization from the Consultant shall be obtained by the Contractor before alternatives are purchased or installed.

1.8.3. Not used.

1.8.4. The Consultant’s decision regarding the acceptance or rejection of the proposed substitution shall be final. Substitutions may be accepted if the delivery of the component or item is such that it will not jeopardise the construction schedule. Otherwise, the substitution may not be approved.

1.9. EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

1.9.1. Materials and equipment supplied under this Division shall be new and free from defects.

1.9.2. All equipment and material for which there is a listing service shall bear a ULC and/or CSA label.

1.9.3. Equipment shall meet all applicable FCC/CRTC Regulations.

1.9.4. Materials shall have a flame spread in accordance with local Authorities Having Jurisdiction, and in accordance with the electrical specifications as part of this project.

1.10. DOCUMENT FORMAT

1.10.1. This document has been constructed based on a 3 part specification for Division 27. The first part 'General' describes general information pertaining to the section. The second part 'Product' describes the products that shall be supplied and installed for the project. The third part 'Execution' details the requirements for the installation of the specified products. If a product is listed in section 2, the Contractor shall reference sections 1 and 3 for the relevant General information and Execution requirements of that product.

2. Products

2.1. SYSTEM PERFORMANCE

2.1.1. 4-Pair Horizontal Copper Cabling– Data System

All components of the horizontal data channel shall meet the Minimum performance characteristics of:

.1 Category 6a – 500MHz and a data rate of 10Gb/s, with an outside diameter no greater than 0.27"

2.2. CERTIFICATION

2.2.1. The Contractor shall ensure the Cabling Subcontractor will supply and install a complete end to end Structured Cabling Solution. The entire system Channel must be manufactured, warranted and certified by a single manufacturer, unless expressly written in this document.

2.2.2. The Contractor shall ensure the Cabling Subcontractor is authorized and certified by the manufacturer to install and warranty the Solution. The Cabling Contractor's technicians designated to the project must be fully trained by the manufacturer to install the respective system. If a Sub-contractor is approved to be used for the installation, it is mandatory that the Sub-contractor be currently authorized and certified to install and warranty the Solution.

2.2.3. The acceptable manufacturers for the complete 4-pair horizontal voice & data systems for this installation are listed below.

Manufacturer	**Contractor Certification**
Belden Incorporated	CSV – Certified Systems Vendor
Panduit Corporation	NCI – NetKey Installer Certified
CommScope Corporation	VAR – Value Added Reseller
Or Equivalent	Must be submitted to Region and Consultant for consideration

2.2.4. Execution

2.3. TERMINATION REQUIREMENTS

2.3.1. All copper cabling must be terminated using EIA/TIA 568A configuration, unless noted otherwise.

2.3.2. All multimode and single mode fibre optic cabling shall be terminated using field installable connectors unless expressly written in this document. Splicing techniques such as mechanical and heat shrink fusion splicing shall be utilized where specified.

2.4. SITE EXAMINATION

2.4.1. Prior to submitting its Bid, the Contractor shall ensure that the Contractor and its Cabling Subcontractor perform a site survey to familiarise themselves with the site and all conditions of the site affected by the proposed work. The only opportunity to visit the Site prior to submitting the bid would be during the Bidder's Meeting on site. No claims for extra payment will be considered because of failure to examine the Site conditions.

END OF SECTION 27 00 05.10

1. General

1.1. DEFINITIONS

1.1.1. Generally, the following definitions are used in this Division:

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.
Cabling Subcontractor	-	The person, firm or corporation not contracting with or employed directly by the Region but who performs the work associated with the supply and installation of the Structured Cabling Solution as detailed in the Contract Documents and associated Drawings under an agreement with the Contractor or under an agreement with another subcontractor.
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.
Channel Solution	-	Complete end to end connection including patch cords, cable and termination device(s).
Communications Subconsultant	-	Dino Arrogante Smith + Andersen 1100-100 Sheppard Ave, Toronto, ON M2N 6N5

Cut Over	-	The live date(s) when the Region 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 female jack (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 the Contract Documents.
Provide	-	Supply and install.
Vendor		Supplier
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.

1.2. ABBREVIATIONS

1.2.1. Generally, the following abbreviations are used in this Division:

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	-	Audiovisual
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)
CCIA	-	Computer Communications Industry Association
CCTV	-	Closed Circuit Television
CD	-	Compact Disc
CEC	-	Canadian Electrical Code
CEF	-	Cable Entrance Facility
CENELEC		Comite Europeen de Normalisation Electrotechnique
cm	-	Centimetre
CMP	-	Communications Plenum
CMR	-	Communications Riser
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
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
ELT		Electrical Testing Laboratory
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
ft^2	-	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 Cross-connect
ICEA		Insulated Cable Engineers Association
ID	-	Inside Diameter
IDC	-	Insulation Displacement Connection
IDC	-	Insulation Displacement Connector
IDC	-	Insulation Displacement Contact
IDF	-	Intermediate Distribution Frame
IEC		International Electrotechnical Commission
IEEE®	-	Institute of Electrical and Electronics Engineers, Inc.®
IG	-	Isolated Ground
in	-	Inch
in^2	-	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
LSZH	-	Low Smoke Zero Halogen
m	-	Metre
m^2	-	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
MDVO		MDVO RJ45 Jack
MGB	-	Main Grounding Busbar
MHz	-	Megahertz
mi	-	Mile
MIMS	-	Mineral Insulated Metal Sheathed
min	-	Minute
mm	-	Millimetre
MM	-	Multimode
MMF	-	Multimode Fibre
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
ODBC		Open Database Connectivity
OEM	-	Original Equipment Manufacturer
OF	-	Optical Fibre
OSP	-	Outside Plant
PBX	-	Private Branch Exchange
PDU	-	Power Distribution Unit
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
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 System
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
TIA		Telecommunications Industry Association
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 Telehone
TV	-	Television
TX	-	Transmit
TX	-	Transmitter
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
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
WiFi	-	Wireless Fidelity
Wi-Fi	-	Wireless Fidelity
WLAN	-	Wireless Local Area Network
WMAN	-	Wireless Metropolitan Area Network
WWAN	-	Wireless Wide Area Network
X	-	Cross-connect

XLPE	-	Cross-linked Polyethylene
XPE-PVC	-	Expanded Polyethylene Polyvinyl Chloride

2. Products

2.1. NOT USED

3. Execution

3.1. NOT USED

END OF SECTION 27 00 05.20

1. General

1.1. WORK INCLUDED

1.1.1. Code, Standard and Regulation Compliances

.1 The Cabling Contractor shall adhere to all Codes, Standards, Regulations and documents listed throughout this document.

.2 All products installed must meet or exceed all Local, Provincial and Federal Building, Fire, Health, Safety and Electrical Codes.

.3 The non-plenum/plenum cable shall be ETL or ULC Listed and CSA Certified as type CMR/CMP, in accordance with the Binational Standard for Communications Cable, UL444/C22.2 No. 214-17.

.4 The equipment, material and installation shall conform to the latest version of the applicable Codes, Standards and Regulations of Authorities Having Jurisdiction as indicated in Table 1. In the case of conflict or discrepancy the more stringent code, standard or regulation shall apply.

Table 1: Applicable Codes, Standards and Regulations

STANDARD	**TITLE**
ANSI/ICEA	
S-80-576	Communication Cables.
S-83-596-	Optical Fibre Premises Distribution Cable, latest version
S-87-640-	Optical Fibre Outside Plant Communications Cable, latest version
S-104-696-	Standard for Indoor-Outdoor Optical Cable, latest version
Z136.2	American Standards for the Safe Operation of Optical Fibre Communication Systems Utilizing Laser Diode and LED Sources.
ANSI/TIA/EIA	
455-C	Optical Fibre Test Procedures.
472CAAA-93	Detail Specification for All-Dielectric (Construction 1) Optical Fibre Communications Cable for Indoor Plenum Use, Containing Class Ia, 62.5 mm Core Diameter/125 Cladding Diameter Optical Fibre(s).
472DAAA-93	Detail Specification for All-Dielectric Optical Fibre 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).
492AAAA-09	Detail Specification for 62.5-mm Core Diameter/125-mm Cladding Diameter Class Ia Multimode, Graded-Index Optical Waveguide Fibres.
492AAAB-09	Detail Specification for 50.0-mm Core Diameter/125-mm Cladding Diameter Class Ia Multimode, Graded-Index Optical Waveguide Fibres.
492CAAA-98	Detail Specification for Class IVa Dispersion-Unshifted Singlemode Optical Waveguide Fibres Used In Communications Systems.
568.1-D	Commercial Building Telecommunications Cabling Standard: General Requirements.
568.2-D	Commercial Building Telecommunications Cabling Standard: Balanced Twisted Pair Cabling.

STANDARD	**TITLE**
568.3-D	Commercial Building Telecommunications Cabling Standard: Optical Fibre Cabling Components Standard.
569-D	Commercial Building Standard for Telecommunications Pathways and Spaces including all addenda
598-D	Optical Fibre Cable Color Coding, latest version
570—D	Residential Telecommunications Infrastructure Standard.
604-5-E	FOCIS 5 Fiber Optic Connector Intermateability Standard- Type MPO
606-C	Administration Standard for Telecommunications Infrastructure
607-C	Telecommunications Grounding (Earthing) and Bonding for Customer Premises
758-B	Customer Owned Outside Plant Telecommunications Cabling Standard.
862-B	Structured cabling infrastructure Standard for Intelligent Building Systems
942-B	Telecommunications Infrastructure Standard for Data Centers
1005-A	Telecommunications Infrastructure Standard for Industrial Premises
CSA	
C22.1-18	Canadian Electric Code Part I: Safety Standards for Electrical Installations.
C22.2 No. 182.4-M90	Plugs, Receptacles, and Connectors for Communication Systems. R2015
C22.2 No. 214-17	Communications Cables.
CAN/CSA-C22.2 No. 0-10	General Requirements, Canadian Electrical Code, Part II (latest version)
CAN/CSA-C22.2 232-17	Canadian Electric Code Part II: Optical Fibre Cables.
T527-94	Grounding and Bonding for Telecommunications in Commercial Buildings.
T528-93	Design Guidelines for Administration of Telecommunications Infrastructure in Commercial Buildings
T529-95	Design Guidelines for Telecommunications Wiring Systems in Commercial Buildings.
T530-99	Commercial Building Standard for Telecommunications Pathways and Spaces (latest version)
OTHER	
CAN/ULC-S115:2018	Standard Method of Fire Tests of Firestop Systems.
CAN/ULC S101-14	Standard Method of Fire Endurance Tests of Building Construction and Materials.
CAN/ULC S102:latest version	Standard Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies.
CENELEC EN 50173	Performance Requirements for Generic Cabling Systems.
CLC	Canada Labour Code, Part II Occupational Health and Safety, and Provincial and Local Health and Safety regulations
ICEA S-90-661	Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cables (with or without an overall shield) for use in General Purpose and LAN Communication Wiring Systems Technical Requirements
IEC 60603-7, 3.2 (latest version), Part 7	Connectors for electronic equipment - Part 7: Detail specification for 8-way, unshielded, free and fixed connectors

STANDARD	TITLE
ISO/IEC IS 11801-1:2017(E)	Generic Cabling for Customer Premises.
NEMA WC 63.1-latest version	Performance Standard for Field Testing of Unshielded Twisted-Pair Cabling System.

.5 Comply with all Local, Provincial and Federal codes for fire and electrical, as well as all local laws, where applicable and with requirements of the Canadian Standards Association (CSA) when mandatory. Make any changes or alterations required by the authorised inspector of the Authority Having Jurisdiction, at no extra charge to the Region.

1.1.2. General Installation Requirements

.1 Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment, apparatus and installation of systems cabling solution furnished into premises. These items shall be removed from premises when no longer required.

1.1.3. Cutting, Patching and Repairing

.1 Contractor shall ensure the Cabling Subcontractor performs all cutting, patching and repair related to the Communications Cabling work including any penetrations through walls or floors.

2. Products

2.1. NOT INCLUDED IN THIS SECTION

3. Execution

3.1. CODE, STANDARD AND REGULATION COMPLIANCES

3.1.1. All cables and components shall be installed and terminated in accordance with CSA, ANSI/EIA/TIA-568B and its Amendments as well as UL/ULC Guidelines. Particular attention shall be given to maintaining the integrity of the pair twists, bend radius and ensuring proper distance is kept from fluorescent light fixtures, electrical cables or any other source of EMI. Cables shall be combed and bundled in a neat and organised manner. The Communications Engineer's Representative will determine neatness of the installation. Cables that have not been properly combed and dressed shall be re-dressed at the Cabling Contractor's expense. Ensure the Cabling Contractor co-ordinates with the Consultant prior to termination in any Telecom Room.

3.1.2. The maximum horizontal run length for 4-pair cabling shall not exceed 90-metres. If the 90-metre constraint cannot be met, the Cabling Contractor shall notify the Communications Engineer's Representative of any cables that exceed 90-metres, prior to their installation.

END OF SECTION 27 00 05.30

1. General

1.1. WORK INCLUDED

1.1.1. Drawings list

.1 Refer to the Index for a list of Drawings that shall be used for preparation of bids and construction.

.2 A hard copy of the Drawings will be supplied to the Contractor for Construction.

2. Products

2.1. NOT INCLUDED IN THIS SECTION

3. Execution

3.1. COORDINATION

3.1.1. Carefully examine work and Drawings of all related trades and thoroughly plan the work so as to avoid conflict or interference with other services. Report defects that would adversely affect work. Do not commence installation until defects have been corrected.

3.1.2. Co-ordinate work of this Contract such that items will properly interface with the work of other Contracts. Prepare installation drawings of critical locations and submit to the Consultant for review.

END OF SECTION 27 00 05.50

1. General

1.1. WORK INCLUDED

1.1.1. Submittals – Drawing Documentation and Cable Test Results

.1 The Contractor shall ensure the Cabling Subcontractor is provided with Drawing(s) for construction on which the Cabling Subcontractor shall clearly mark all changes and deviations during the construction process, which shall include the pathway of the cables from the Telecom Room(s) to the Workstations or between Telecom Rooms. Drawing(s) shall be kept up-to-date during construction and in addition to field measurements shall include field instructions and all other changes. The as-built drawing(s) shall also include all additional cables installed during the project. The Consultant shall have the right to review the status of the as-built drawing(s) from time to time during the construction process. On completion of the project, the Contractor shall ensure the Cabling Subcontractor forwards to the Consultant two sets of drawings indicating all such changes and deviations for review within 5 Working Days of the completion of the project.

.2 The Contractor shall ensure the Cabling Subcontractor supplies (temporary hand-marked) as-built drawings to the Consultant for Region's use 3 days prior to cut-over.

.3 The Cabling Subcontractor shall request (via email) from the Consultant a soft copy of the Drawings for use by the Cabling Subcontractor in preparation for record (as-built) drawings. The Contractor shall ensure the Cabling Subcontractor updates the soft copy Drawing(s) with correct as-built information (i.e. cable numbers, outlet locations, rack/backboard elevations, etc.) in digital format using AutoCAD 2004 or better.

.4 All changes to Drawing(s) shall be done electronically. All Voice, Data and Coaxial outlet locations shall be identified with proper designation.

.5 If the Contractor cannot ensure the Cabling Subcontractor complies with this requirement, the Consultant will transfer all hand drawn as-builts to AutoCAD. The cost for this service shall be based on per diem rates at time of completion. The Contractor shall be responsible for the costs associated with this work.

.6 The Contractor shall ensure the Cabling Subcontractor prints and plots two sets of as-built drawings at no extra cost. Final as-built print(s)/plot(s) shall not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.) and shall be delivered to the Consultant or final review and delivery to the Region.

.7 The Contractor shall ensure Cabling Subcontractor produces a test report based on the cable schedules. The report shall indicate for each cable, when it was tested successfully and the signature of the technician that performed the test. An authorized person for the Cabling Subcontractor must sign the entire report. The Cabling Subcontractor is also required to supply 1 soft copy on CD(s) in the tester's native format, along with the appropriate software to read the test results. These files shall be provided on a CD(s) separate from the record drawings CD(s).

.8 The project will remain incomplete and a holdback will be retained until satisfactory as-built drawing(s) and cable test results are provided.

1.1.2. Submittals – Testing and Commissioning

.1 Provide testing and commissioning documentation for all items and their related components to the Consultant prior to the completion of the project or at the Consultants request. Include maintenance manuals and operating instructions for Region's staff use.

1.1.3. Submittals – Shop Drawings

.1 Shop Drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each Shop Drawing shall give the identifying number of the specific assembly for which it was prepared.

.2 Each Shop Drawing for non-catalogue items shall be prepared specifically for this project. Shop Drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.

.3 Each Shop Drawing or catalogue sheet shall be stamped and signed by the Communications Subcontractor to indicate that it has checked the drawing for conformance with all requirements of the drawings and specifications, that it has co-ordinated this equipment with other equipment to which it is attached and/or connected and that he has verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the work of other trades. Ensure that communications co-ordination is complete before submitting drawings for review.

.4 Installation of any equipment shall not start until after final review of Shop Drawings by the Consultant has been obtained.

.5 When requested, Shop Drawings shall be supplemented by data explaining the theory of operation. The Consultant may also request that this information be added to the maintenance and operating manual.

.6 Provide space for Shop Drawing review stamps for the Communications Subcontractor and Consultant. This space shall be clear of all technical information and shall not be on the back of any sheets.

.7 One original Shop Drawing will be returned. All copies required for the trades, suppliers or other Consultants will be printed by the Contractor.

1.1.4. Permits, License Reviews and Fees

.1 Where materials are specified in the Contract Documents which require special review and approval of CSA and/or local Authorities Having Jurisdiction obtain such approval for the particular installation with the co-operation of the material supplier. Obtain and pay for permits and reviews required for work performed.

.2 Submit required Documents and Shop Drawings to Authorities Having Jurisdiction in order to obtain approval for the work. Copies of Contract Drawings and Specifications may be used for this purpose. Prepare any additional information, details and drawings that these Authorities may require.

1.1.5. Substitutions and Alternate Products

.1 In order to be assessed, proposed substitutions must include the following:

.1 Description of proposed substitution.

.2 Respective cost of items originally specified and the proposed solution.

.3 Compliance with the applicable Building Codes and the requirements of Authorities Having Jurisdiction.

.4 Compliance with the applicable telecommunications standards.

.5 Affect concerning compatibility with and interface with adjacent building materials and components.

.6 Compliance with the intent of the Contract Documents.

.7 Reason(s) for the request.

.2 Substitution submissions do not relieve the Contractor from the obligation of preparing and submitting a tender response that is in complete compliance with this specification document and associated Drawings. Any substitution submissions must be clearly outlined in addition to the original specified equipment as detailed in this document and associated Drawings and submitted for consideration to the Consultant after award of the Contract.

1.1.6. Scheduling

.1 Within one week of award of the Contract, the Contractor shall submit a formal project schedule to the Consultant showing start and finish dates of major tasks as denoted by system, horizontal cabling, material order and delivery to site and testing.

.2 Updated schedules shall be submitted as periodically requested by Consultant.

1.1.7. Cleanup

.1 The Contractor shall ensure the Cabling Subcontractor keeps the Site and surrounding area clean, safe and free from debris at all times. All debris must be removed from the site on a daily basis at no additional cost to the Contract.

.2 Upon completion of the work and before acceptance and final payment will be made, the Contractor shall ensure the Cabling Subcontractor cleans and removes from the Site, all surplus and discarded materials, temporary structures and debris of every kind. Surplus and waste materials removed from the Site shall be disposed of in accordance with applicable laws and regulations.

.3 Before acceptance by the Consultant, all the equipment and cabling must be cleaned and tested.

1.1.8. Review and Testing Requirements

.1 The Consultant must approve the testing procedure prior to testing commencing and may request to be present during the initial testing.

.2 The Consultant shall be invited to witness field testing and shall be notified of the start date of the testing phase a minimum of 5 Working Days before testing commences. Upon completion of the testing by the Cabling Subcontractor the Consultant may ask the Cabling Subcontractor to perform a random test of up to 10% of the links. The Cabling Subcontractor shall test these randomly selected links and the results shall be stored in accordance with this document. The results obtained shall be compared to the original test data. If more than 2% of the sample results differ in terms of the pass/fail determination, the Contractor shall ensure the Cabling Subcontractor under supervision of the Consultant repeats 100% testing at no additional cost to the Contract.
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1.1.9. Submittals – Connectivity Database

.1 The Contractor shall ensure the Cabling Subcontractor prepares separate Data Connectivity Databases in Microsoft Excel spreadsheet format that includes the following:

Data (VoIP) - For data connectivity, this shall include but shall not be limited to workstation ID or number, horizontal Data cable number, active equipment port and copper cable.

.2 The Cabling Contractor will only be required to provide this information when the Cabling Contractor is responsible for the installation of patching of the data system.

.3 One soft copy shall be supplied to the Consultant.

2. Products

2.1. NOT INCLUDED IN THIS SECTION.

3. Execution

3.1. NOT INCLUDED IN THIS SECTION.

END OF SECTION 27 00 05.60

1. General

1.1. WORK INCLUDED

1.1.1. Cable Installation

.1 The entire cable installation shall be done during hours specified in SC 2 of Supplementary Condition of the Contract; and as outlined in the project schedule.

1.1.2. Floor/Ceiling Tiles

.1 The Contractor shall ensure the Cabling Subcontractor will remove and re-install all floor/ceiling tiles in areas affected by the work of Division 27. This shall be done on a daily basis for all areas that are occupied during the construction period. Otherwise the Contractor shall ensure the Cabling Subcontractor removes and re-install the tiles after the work of this Division is complete.

.2 Any damage to ceiling tiles during the installation of any work described in the Contract Documents shall be the responsibility of the Contractor. Damages include chipping, breaking or soiling. Final decisions on the trade responsible for any damage to ceiling tiles shall be made by the Project Manager and the Consultant.

.3 The Contractor shall ensure the Cabling Subcontractor stores and protects floor/ceiling tiles when they have been removed from the floor/ceiling grid.

1.1.3. Safety of Persons and Property

.1 The Contractor shall ensure the Cabling Subcontractor shall complies with all laws, ordinances, rules, regulations, policies of the Region and lawful orders of any public Authority Having Jurisdiction for safety of persons or property or to protect them from damage, injury or loss.

.2 Moderate public pedestrian traffic should be expected around all work locations. Ladders scaffold, installation materials, and all other hazardous conditions shall be fully protected at all times. Warning cones, signs, barricades and warning tapes shall be used to warn and protect persons and property at all times in public corridors.

.3 Work shall not interfere with legal fire exits. Corridors, areas of egress, fire protection stand pipes, hydrants and exit stairs shall be maintained at all times.

.4 No open flames/smoking shall be permitted without prior written approval of the Region.

.5 The Contractor shall ensure the Cabling Subcontractor sets up and removes all signage and safety measures to ensure that other trades and non-trade personnel are safe from work of the Cabling Subcontractor.

1.1.4. Access to Site

.1 The Contractor shall coordinate site access with the Cabling Subcontractor, Consultant and Region as determined during the initial project meeting.

1.1.5. Identification

.1 All Cabling Subcontractor personnel shall be clearly identified by either uniform or company ID. In addition, the Cabling Subcontractor may be required to wear Region provided ID for required card access locations or identification. All Region ID(s) must be returned daily or at the end of the project as determined by the Region.

1.1.6. Emergency Facilities

.1 The Contractor shall ensure the Cabling Subcontractor maintains at all times free access to fire lanes and emergency and utility control facilities such as fire alarm boxes, utility vaults, manholes and junction boxes.

1.1.7. Product Delivery Requirements

.1 The Contractor shall ensure the Cabling Subcontractor is responsible for complete delivery, handling, and installation of all materials used in the performance of the work of Division 27.

1.1.8. Product and Tools Storage Requirements

.1 The Contractor shall ensure the Cabling Subcontractor is responsible for complete storage and handling of all materials used in the performance of the work.

.2 The Contractor shall ensure Cabling Subcontractor is allowed to store job boxes on the Site during construction. The tools and the job box shall be the responsibility of the Cabling Subcontractor. The Region and the Consultant shall be in no way responsible or liable for any tools of the Cabling Subcontractor.

1.1.9. Confined Spaces

.1 The Contractor shall ensure the Cabling Subcontractor complies with the health and safety requirements of the Authorities Having Jurisdiction and Region specific safety requirements, if work is to be performed in a confined space.

1.1.10. Coordination with Occupants

.1 The Contractor shall be responsible for co-ordinating all work with Cabling Subcontractor, the Region and other trades of the floor space for their daily work.

1.1.11. Project Meetings

.1 The Contractor shall ensure that it and the Cabling Subcontractor attend site meetings when requested by the Consultant and/or the Region' Project Manager. Regular meetings may occur once per week at the Consultant's and/or the Region's Project Manager's discretion.

.2 The Contractor shall attend weekly project meetings throughout the duration of the project to review the status of current and planned activities, schedule and conduct other business associated with the project.

1.1.12. Progress Reports

.1 The Contractor shall ensure the Cabling Subcontractor issues a status report at the weekly project meeting including status of: progress, project completion for phases, material ordering and delays.

2. Products

2.1. NOT INCLUDED IN THIS SECTION

3. Execution

3.1. PRODUCT DELIVERY REQUIREMENTS

3.1.1. The Contractor shall ensure the Cabling Subcontractor unloads materials from delivery trucks in such a manner as to protect the materials from damage. In particular, reels of cable shall not be unloaded by dropping them off the vehicle.

3.2. PROTECTING INSTALLED SYSTEMS AND CONSTRUCTION

3.2.1. The Contractor shall ensure the Cabling Subcontractor is responsible for the assembly of above equipment/materials and protection of the above equipment and related items until project cut over. Any damage to equipment shall be the responsibility of the Contractor. All damage shall be repaired, or at the Region's request, the equipment shall be replaced at no extra charge to the Region.

END OF SECTION 27 00 05.70

1. General

1.1. WORK INCLUDED

1.1.1. Fire Stopping

.1 Provide seals in all Fire Rated Separations and Firewalls to form tight barriers to retard the passage of flame and smoke.

.2 The installed seals shall provide and maintain the fire resistance rating of the adjacent floor, wall or other fire separation assembly to the Ontario Building Code Requirements.

.3 The Contractor shall ensure the Cabling Subcontractor shall establish/re-establish the integrity of all fire-rated structures and assemblies that they have created or disturbed, or were created by others for use by the Cabling Contractor.

.4 Supply and install Fire Stop pillows for existing cable tray penetrations through firewalls.

.5 For the purposes of this specification, the only acceptable Fire Stop Systems shall be those that have been tested to the CAN/ULC S115 Standard.

.6 Supply and install non-permanent CSA approved Fire Stop systems that are dielectric, water resistant, non-hardening, permanently pliable/re-enterable putty along with the appropriate damming or backer materials (where required).

.7 All fire stopping shall maintain a minimum one hour rating and shall meet applicable Federal, Provincial and Local building codes.

.8 All Fire Stop Systems shall be listed and tested by an SCC and accredited Third Party Testing Agency in accordance with the CAN/ULC S115 Standard.

.9 Fire resistance ratings of installed Fire Stop Systems shall not be less than the fire resistance rating of the surrounding Fire Separation or Firewall.

.10 All Smoke Seals selected for use shall comply with CAN/ULC S115 Standard.

.11 All Fire Stop Materials and Smoke Seals shall have elastomeric characteristics to allow for building settling and seismic movement. All Fire Stop Materials and Smoke Seals shall be free of asbestos.

1.1.2. Quality Assurance

.1 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 Provide the work of this Section using competent installers, experienced in the application of the materials and systems being used, approved and trained by the material or system manufacturer.

.3 Fire Stop Systems shall conform to the fire (F), hose (H) and temperature (T) ratings of the CAN/ULC S115 Standard.

.4 Fire Stop Materials and Smoke Seal materials shall have a flame spread rating of 25 or less, National Fire Protection Association (NFPA Class "A").

.5 For the purposes of this specification the only acceptable Fire Stop Systems are those that have been tested to the CAN/ULC S115 Standard.

1.1.3. Performance

.1 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.

.2 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.

.3 Where it is not practical to use a mechanical device, openings within floors and walls designed to accommodate telecommunications and data cabling shall be provided with re-enterable products that do not cure or dry.

.4 Openings for cable trays shall be sealed using re-enterable fire stopping pillows.

1.1.4. 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.

2. Products

2.1. GENERAL

2.1.1. 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.

2.2. MANUFACTURERS

2.2.1. Products manufactured by Hilti (or Equivalent) are acceptable.

2.2.2. Obtain fire stop systems for each type of penetration and construction condition indicated only from the same manufacturer.

2.3. MATERIALS

2.3.1. Firestop Sealants: The following products are acceptable.

.1 Hilti FS-ONE MAX high performance Intumescent Firestop Sealant

.2 Hilti CP 601S Elastomeric Firestop Sealant

.3 Hilti CP 606 Flexible Firestop Sealant

.4 Hilti CP 604 Self-Leveling Firestop Sealant

.5 Or Equivalent

2.3.2. Cast-In Firestop Device: A one-step cast-in firestop device for a variety of pipe materials and diameters. The following product is acceptable.

.1 Hilti CP 680-M Cast-in Firestop Device or Equivalent

2.3.3. Firestop Putty: An intumescent, non-hardening, firestop putty for cable and pipe penetrations. The following product is acceptable:

.1 Hilti CP 618 Firestop Putty Stick or Equivalent

2.3.4. Firestop Plug: Ready-to-use intumescent and reusable plug for small openings. The following product is acceptable:

.1 Hilti CFS-PL Firestop Plug or Equivalent

2.3.5. Fire Rated Cable Pathways: Re-penetrable cable management device:

.1 Hilti CP 653 Speed Sleeve or Equivalent

3. Execution

3.1. FIRE STOPPING

3.1.1. 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.

3.1.2. Examine sizes and conditions of voids to be filled to establish correct thickness and installation of Fire Stop Materials.

3.1.3. Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion

3.1.4. Prepare surfaces in contact with Fire Stop Systems and Smoke Seals to manufacturer's instructions. Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.1.5. The Contractor shall ensure that the Cabling Subcontractor shall be required to install/replace sound barrier/fire stopping materials as soon as cables have been pulled through the opening.

3.1.6. In all Fire Stop Systems that require mineral wool or ceramic fibre backer or filler materials, these materials shall be dry and free of other contaminants before, during and after installation of sealant Fire Stop Materials. Alkaline water contamination of the backer or filler materials may cause corrosion of metallic penetrating items.

3.1.7. Apply Fire Stop Systems and Smoke Seals in strict accordance with manufacturer's instructions to prevent the passage of fire and smoke, and where required and / or specifically designated, the passage of fluids.

3.1.8. Provide temporary forming and packing as required. Tool or trowel all exposed surfaces to smooth, neat and tidy finish.

3.1.9. Fire Stop and smoke seal gaps and holes in all Fire Separation and Firewall construction through which cables pass as a result of work in this Division.

3.1.10. In Combustible Construction (membrane GWB type) where the framing members are wood or where paper faced insulation is incorporated within the separation, a Fire and Temperature rise "FT" rating is required equal to that of the rating of the Fire Separation. Include openings which have been formed and sleeved.

3.2. CLEAN UP

3.2.1. Remove excess materials and debris and clean adjacent surfaces immediately after application to satisfaction of the Region's Project Manager. Remove and or correct staining and discolouring of adjacent surfaces as directed.

END OF SECTION 27 00 06.00

1. General

1.1. WORK INCLUDED

1.1.1. Labour Allowance

.1 The Contractor shall allow for cable removal in its total bid price, based on the scope of work indicated in this section and on any associated demolition Drawings.

.2 The Contractor shall confirm with the Consultant prior to any cable being removed. The Contractor shall forward a schedule indicating the locations and times for cable removal to the Consultant.

.3 In occupied areas where there is no hoarding, remove and re-install ceiling tiles on a per shift basis unless directed otherwise by the Region.

1.1.2. Cable and Equipment Removal

.1 The extent of demolition work to be included in this Contract shall be delineated in included demolition Drawings and associated detail Drawings.

.2 Where identified on Drawings, the Contractor shall ensure the Cabling Subcontractor removes cable and equipment only within specified areas; otherwise, cable and equipment removal area in scope shall encompass the entire floor(s).

.3 Co-ordinate all work with the current use of the building(s).

.4 Maintain all telecommunications services to all parts of the building which are to remain in use. The Contractor shall schedule all work and inform the owner in writing at least one week in advance for permission of any necessary shutdowns or outages indicating proposed time(s) and duration(s) of interruptions.

.5 The Contractor shall consult with the Owner and determine the equipment required to be on line 24 hours per day and provide temporary services and wiring as necessary. Reschedule work accordingly when requested by the project manager and/or owner.

.6 Include cost of premium time in total bid price for work during nights, weekends or other time outside the Contractor's normal working hours necessary to maintain all telecommunications services in operation. Refer to SC 2 of the Supplementary Conditions.

.7 Scope of Demolition:

.1 Work shall include for removal, relocation and reinstallation of telecommunications devices/systems/infrastructures in the areas noted on the Drawings. This shall include, but not necessarily be limited to:

.1 Disconnecting, removal and/or reinstallation of all telecommunications devices/systems/infrastructures to accommodate new work. Refer to relevant electrical, architectural, structural and mechanical drawings to determine exact scope of work.

.2 All work and material disposal shall be done in accordance with the established schedule and General Conditions.

.3 All services passing through the area of work, but servicing other areas of the building shall be identified, protected and left in place, unless otherwise noted in the Contract Documents.

.4 All telecommunications devices/systems/infrastructures shall be traced and identified by the Contractor for review by the Consultant and/or Owner in order to determine if services are to remain or to be removed. Once

identified, the Contractor shall ensure the Cabling Contractor removes those services as identified.

.5 Disconnect and remove all existing services, devices and wiring materials which are abandoned.

.8 Disposal of Materials

.1 All material removed from the Site shall be disposed of in accordance with all applicable environmental legislation and regulations of the local Authorities Having Jurisdiction and as noted elsewhere in the specifications.

.2 Separate and recycle materials to be disposed to the maximum extent possible.

.9 Hazardous Materials

.1 If at any time during course of work hazardous materials are encountered or suspected, cease work in area in question and immediately report, in accordance with local regulation on hazardous materials to the Consultant and the Owner. Do not resume work in affected area without approval from the Consultant.

2. Products

2.1. NOT INCLUDED IN THIS SECTION

3. Execution

3.1. CABLE IDENTIFICATION

3.1.1. Prior to removal of Communications Cabling, the Contractor shall ensure the Cabling Subcontractors identifies all existing non-active cabling (as well as active cabling to remain), and verify the location and extent of removal with the Region. The Contractor shall ensure the Cabling Contractor tones out cables to ensure the intended cables are demolished.

3.2. REMOVAL OF MATERIALS

3.2.1. Protect all removed (to be retained) equipment from damage. Repair or replace without adjustment to the contract price all existing equipment which is damaged in process of relocation.

3.2.2. The Contractor shall ensure the Cabling Subcontractor turns over to the Region all racks, cabinets, accessories, patch panels and voice connectivity hardware for re-use. If items are not to be re-used, the Contractor shall ensure the Cabling Subcontractor confirms disposal with the Region.

3.2.3. Ensure the Cabling Contractor disposes on a daily basis all cabling and components that are removed. Include all costs of removal and disposal in the Contractor's total bid price.

3.2.4. No equipment may be burned or sold on site.

3.3. SYSTEMS TO REMAIN

3.3.1. All services and equipment not shown on Drawings shall be maintained in operation during the construction phase. The Contractor shall ensure the Cabling Subcontractor shall be required provides new wiring for any existing systems to remain so that the existing systems do not interfere with new work. The Contractor shall ensure the Cabling Subcontractor removes existing devices and reconnect to new services accordingly.

3.3.2. Maintain operation of all systems outside of the renovated area which may be affected by the renovation.

3.3.3. Any circuits which have been made inoperative as a result of this work but are not in an area to be demolished shall be reactivated at no cost to the Owner.

3.3.4. Trace out and catalogue all circuits within the renovated area and adjacent areas. Mark this information on a set of Drawings prior to any work commencing as these circuits will be reused as part of this work as noted on the Drawings or called for in the Contract Documents.

3.3.5. Clean and test existing equipment/cabling which is to remain, and equipment/wiring being reinstalled in areas being renovated for proper operation and repair as necessary before being put back into service.

3.3.6. The Contractor shall ensure the Cabling Subcontractor verifies operation of all existing devices and reports any discrepancies to the Contractor's project manager and/or owner prior to proceeding with the work.

3.3.7. Unless noted otherwise in the Contract Documents provide additional equipment of the same type and from the same manufacturer where required to supplement existing equipment.

3.4. INTERFACE WITH EXISTING SYSTEMS

3.4.1. Provide interfacing components between new and existing systems as necessary for proper performance and operation.

3.4.2. Check and coordinate all systems in the renovated area and in the new building addition (if applicable), which are extended to existing systems to ensure their proper operation.

3.5. FIRE STOPPING AND WATERPROOFING

3.5.1. As per Section 27 00 06.00, the Contractor shall ensure the Cabling Subcontractor makes good all Fire Stopping and Waterproofing where Fire Stopping and/or Waterproofing has been disturbed during cable removal, or where Fire Stopping and/or Waterproofing was non-existent.

END OF SECTION 27 00 07.00

1. General

1.1. WORK INCLUDED

1.1.1. Supply and install cabling as detailed in Contract Documents. The Contractor shall ensure the Cabling Subcontractor uses pathways installed by the electrical Subcontractor to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point they shall use cable support hangers as specified in the Contract Documents.

1.1.2. The Contractor shall not use any mechanical or electrical fittings to support the telecommunications cabling. All telecommunications cabling shall be independently supported.

1.1.3. The Contractor shall independently support the cables above all ceiling tiles and in a manner where the cables do not interfere with the removal of the ceiling tiles. A minimum of 75 mm 3”(in) of clear vertical space above the ceiling tiles shall be maintained.

1.1.4. The Consultant’s project manager must approve all deviations from the contract documents and drawings in relation to cable routing, outlet and equipment locations.

1.2. INDOOR CABLE DISTRIBUTION

1.2.1. Utilise all indicated and available cable pathways such as conduits, communications cable tray, ducts, surface raceways installed by the electrical Subcontractor, and furniture system channels except where otherwise noted in the Contract Documents.

1.2.2. Inside buildings minimize any possibilities of interference by maintaining the following minimum clearances from electrical and heat sources when routing cables.

	Minimum Separation Distances		
Item	(<2kVA)	(2-5kVA)	(>5kVA)
Unshielded power lines or electrical equipment in proximity to open or non-metallic pathway.	127 mm (5”(in))	305 mm (12”(in))	610 mm (24”(in))
Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway.	64 mm (2.5”(in))	152 mm (6”(in))	305 mm (12”(in))
Power lines enclosed in a grounded metal conduit (or Equivalent shielding) in proximity to a grounded metal conduit pathway.	---	76 mm (3”(in))	152 mm (6”(in))
Motors	1.2 m (4’-0”)		
Transformers	1.2 m (4’-0”)		
Fluorescent Luminaires	300 mm (12”)		
Pipes (gas, oil, water, etc.)	120 mm (5”)		
HVAC (equipment, ducts, etc.)	150 mm (6”)		

1.2.3. NON-Continuous CABLE SUPPORT

The Contractor shall ensure the Cabling Subcontractor supplies and installs cable support for the distribution of horizontal and backbone cables where conduit or cable tray has not been

provided. Cable supports shall be manufactured by Erico, Panduit, or Equivalent and sized as per manufacturer recommendations.

1.2.4. Non-continuous cable supports shall be utilized up to the maximum density of cables permitted, as specified by the manufacturer.

1.2.5. Panduit J-Pro or J-Mod cable supports, or Equivalent shall be used where ceiling space rating dictates. J-Pro plenum part numbers are shown for reference below. Substitute Equivalent J-Mod product codes for similar product when required.

Description	Panduit Part#
Wall Mount	JP2W-L20
Ceiling Mount	JP2CMB-L20
Drop Wire & Threaded Rod Clip	JP2DW-L20
Screw-On Beam Clamps	JP2SBC50-L20 or JP2SBC50RB-L20
Hammer On Beam Clamps	JP2HBC25RB-L20 or JP2HBC50RB-L20 or JP2HBC75RB-L20
Purlin Clips	JP2ZP-L20 or JP2CP-L20
Under Floor Pedestal Support Clamp	JP2UF100-L20

1.2.6. The size of J-hooks/support shall suit quantity of cables in runs used for distribution.

1.2.7. Include any other miscellaneous hardware (angled hanger bracket, hammer/screw on clamps) required to support horizontal and backbone cabling.

1.3. VELCRO TIE-WRAPS

1.3.1. It should be noted that only Velcro tie-wraps shall be acceptable. Under no circumstance shall plastic tie-wraps be used. Use the following tie wraps:

Panduit
HLS/HLM-15R0 (Black) or Equivalent

1.3.2. If plastic tie-wraps are used the Contractor shall ensure the Cabling Subcontractor shall be required to remove and replace all affected cables at no cost to the Contract.

1.4. SPIRAL WRAP

1.4.1. Size Spiral Wrap according to quantity of cables being fed into the system furniture. Spiral Wrap colour shall match system furniture manufacturer's power feed.

1.4.2. Panduit : part number: T50F-CX or Equivalent.

2. Execution

2.1. CABLE DISTRIBUTION

2.1.1. Exercise caution when pulling cables in pathways to avoid damage to any existing cables and follow manufacturer's maximum pull-force and minimum bend radii.

2.1.2. All cables and components shall be installed and terminated in accordance with applicable codes, standards and regulations.

2.2. CABLE SUPPORT

2.2.1. Supply and install supports, hanger supports and any other miscellaneous hardware required to support telecommunications cabling where conduit/cable tray has not been provided. Any conduit and cable tray shall be provided by the electrical Subcontractor as indicated on

Division 26 drawings, unless otherwise noted. Contractor shall ensure Cabling Subcontractor determines these requirements based on Communications and Electrical Drawings.

2.2.2. Caddy hangers shall be installed at 4' intervals (maximum). Cables shall be run such that sag between supports does not exceed 4". Secure all cables to J-hooks/supports with Velcro tie-wraps. Cables shall be combed and dressed for all visible portions of the install. The above noted conditions will be strictly checked, and the Contractor shall ensure the Cabling Subcontractor combs and redresses any cables that are unsatisfactory at no additional cost to the Contract.

2.2.3. The Contractor shall ensure the Cabling Subcontractor runs all cable support hangers parallel to building lines.

2.2.4. Cable support hangers or hanger supports must not be drilled into post-tensioned beams under any circumstances.

2.2.5. The Contractor shall coordinate the best time to install the supports with the Cabling Subcontractor with the Region's Project Manager. Refer to the Operational Constraints in the Supplementary Conditions.

2.2.6. Supports shall be sized to accommodate the number of cables in each run. Other hardware such as hammer on clamps, screw on clamps and angled hanger brackets to support the backbone and/or horizontal cabling shall be included.

2.2.7. In the Cable Support Hanger System, each individual run or pathway shall not contain more than fifty (50) UTP horizontal cables. Where these situations arise, provide an additional hanger pathway to divide the cable bundle.

2.2.8. The Cable Support Hanger System shall be completely and independently supported from the structural ceiling or walls (concrete slab/deck) and shall not be supported in any way by the suspended ceiling. Anchors for hangers must not be drilled into post tensioned beams under any circumstances. The Cabling Contractor shall not use Hilti Pneumatic hammers. All anchors must be drilled into slab.

2.2.9. The Contractor shall ensure the Cabling Subcontractor minimizes the disturbance or removal of 'fire spray' insulation during installation of cable supports.

2.3. VELCRO TIE-WRAPS

2.3.1. Velcro tie-wraps shall be used to neatly dress cables; they shall be placed at a maximum of 4' intervals for horizontal distribution (centre points between cable supports).

2.3.2. Velcro tie-wraps shall also be used to dress horizontal cables into racks/cabinet, for each row of the patch panel. Maximum spacing of Velcro for horizontal cables into or along vertical cable managers shall be no more than 6", this includes cabling dropped from the ladder tray or ceiling above.

2.4. SPIRAL WRAP

2.4.1. Install Spiral Wrap from system furniture feed points to system furniture entry point. Spiral Wrap shall be butted so that no cables are exposed.

2.5. CABLE DISTRIBUTION

2.5.1. Ensure ANSI/EIA/TIA-568.1-D installation practices are followed for Indoor cable distribution.

2.5.2. Do not exceed the copper cables maximum tensile rating during installation. Monitor tension of the cable during installation. Use a dynamometer to record installation tension. Use a tension limiting device to prevent the exceeding of maximum pulling tension specifications during installation. The tension limit shall be set at or below the manufacturer's limit. The

cable shall be taken up at intermediate pulling points with an intermediate take-up device as approved by the Communications Engineer's Representative, to prevent over tension on the cable.

2.5.3. Minimum bend radius shall be as per manufacturer's recommendations.

2.5.4. Make cable pulls continuous and steady between pull points. Do not interrupt the pull unless necessitated by excessive tension on the cable.

2.5.5. Protect exposed cable ends from moisture ingress.

2.6. DUCT AND CONDUIT

2.6.1. Clean out each section of duct or conduit by pulling a steel wire brush and mandrel of the correct size through the duct or conduit before pulling cables. Bush, ream and remove any sharp projections on all conduits prior to installation of communications cables. When cleaning ducts, if obstructions are encountered which cannot be removed, advise the Consultant of the problems encountered.

2.6.2. Pull cables in bottom ducts/conduits first, leaving top ducts/conduits for future use. Apply manufacturer's recommended lubricant to cables to reduce friction between the cable and the duct. Cable grip shall be attached to the sheath and its strength members so that no direct force is applied to the conductors/fibres. The cable grip shall have a ball bearing swivel to prevent the cable from twisting during pulling.

END OF SECTION 27 05 28.00

1. General

1.1. WORK INCLUDED

1.1.1. Labelling

.1 Ensure the Cabling Subcontractor will confirm the proper cable designations with the Consultant prior to installation.

.2 CSA T528-93 (ANSI/EIA/TIA-606-C) colour codes shall be adhered to.

.3 Labelling schemes shall be confirmed with the Consultant prior to installation. The cable labelling scheme for all cables at both ends shall be as follows:

1.1.2. Horizontal Cable Labelling

.1 The cable labelling for Horizontal Data cables / Patch Panels shall be as follows:

First Floor with one data closet
D1-0000 to D1-nnnn

First Floor with multiple data closets
D1A-0000 to D1A-nnnn D1B-0000 to D1B-nnnn

Second Floor with one data closet
D2-0000 to D2-nnnn

Second Floor with multiple data closets
D2A-0000 to D2A-nnnn D2B-0000 to D2B-nnnn

Multiple Floors with multiple data closets
Increment the 2nd position of the format above for each floor.

1.1.3. WAP (Wireless Access Point) Naming Convention

.1 Staff Wi-Fi:

1. AP must be labelled: Site FL-RM_AP#. Where Site is Site Name, FL is the floor, RM is the Network Closet Room Number, AP# is the number of AP on that floor and numbering should restart on each floor.
    1. I.e.: AP number 16 on the first floor in the Annex that is cabled back to room 1-006 would be labelled as follows: ANNEX_1_1-006_AP16
2. Data Jack labelling: RM_AP#
    1. I.e.: data jack that is used for AP number 16 on the first floor of the Annex that is cabled back to room 1-006 would be labelled as follows: 1-006_AP16
3. Patch Panel must be labelled: AP#
    2. I.e.: patch panel should be labelled that is used for AP number 16 on the first floor of the Annex that is cabled back to room 1-006 would be labelled as follows: AP16

.2 Public Wi-Fi:

1. Public AP must be labelled: PUB_FL-RM_AP#. Where PUB represents Public WIFI, FL is the floor, RM is the Network Closet Room Number, AP# is the number of AP on that floor and numbering should restart on each floor.
    2. I.e.: Public WIFI AP number 16 on the first floor in the Annex that is cabled back to room 1-006 would be labelled as follows: PUB_1_1-006_AP16
2. Data Jack labelling: PUB_RM_AP#
    3. I.e.: data jack that is used for AP number 16 on the first floor of the Annex that is cabled back to room 1-006 would be labelled as follows: PUB_1-006_AP16
3. Patch Panel must be labelled: PUB_AP#
    4. I.e.: patch panel should be labelled that is used for AP number 16 on the first floor of the Annex that is cabled back to room 1-006 would be labelled as follows: PUB_AP16
4. Cabling for Public WIFI must be on a separate patch panel from the York Region internal network.

2. Products

2.1. LABELLING

2.1.1. All adhesive cable labels shall meet the legibility, defacement, and adhesion requirements specified in ANSI/UL 969 (Ref. D-16). In addition the labels shall meet the general exposure requirements in ANSI/UL 969 for indoor use.

2.1.2. Cable Labels shall be of self-laminating vinyl construction with a white printing area and a clear tail that self laminates the printed area when wrapped around a cable. The clear area must be of sufficient length to wrap around the cable at least one and one-half times.

2.1.3. Panduit Part# LS8E or Equivalent

2.1.4. Easy-mark labeling software. Part# PROG-EMCD or Equivalent.

3. Execution

3.1. LABELLING

3.1.1. All labels must be mechanically printed using a laser printer. Hand-written labels are not permitted.

3.1.2. Provide 25% additional labels to be left in each telecommunications room on site for future growth.

3.2. LABEL LOCATIONS

3.2.1. Cable identification labels shall appear at the following locations with the numbers indicated on the cable schedule and drawings:

.1 102 mm 4”(in) from each end of the cable – after termination.

.2 Front of patch panels.

.3 Front of workstation/communications outlet faceplates.

.4 Each end of each Telecommunications Conduit.

END OF SECTION 27 05 53.00

1. General

1.1. WORK INCLUDED

1.1.1. General Testing Requirements

.1 100% of the installed cabling links must be tested and must pass the requirements of the Standards as defined within the Contract Documents. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.

.2 All deficiencies must be corrected prior to application for Substantial Performance of the Work.

.3 The Contractor shall ensure the Cabling Subcontractor submits a soft copy of test results in Access, Paradox or any other ODBC compatible database formats.

.4 Test patch cords to portable tester must be designed for testing by the manufacturer. Field assembled patch cords are not acceptable. Field testers must use the appropriate jack/tester adapter specified for use with the cabling jack(s) specified within this document.

.5 The Contractor shall ensure the Cabling Subcontractor produces a test report based on the cable schedules. The report must indicate for each cable, when it was tested successfully and the signature of the technician that performed the test, location, cable type, cable number and tester make and model. A sample of the test report must be submitted to the Consultant for approval. The entire report must be signed by an authorised person for the Cabling Subcontractor at the end of the project.

1.1.2. Copper Cabling Test Requirements

.1 Every cabling link in the installation shall be tested (as required by the cabling specified) in accordance with the Telecommunications Industry Association (TIA) Standard ANSI/TIA/EIA-568.1-D.

.2 The installed twisted-pair horizontal links shall be tested from the Telecom Room to the workstation against the “Permanent Link” performance limits Specification as defined in ANSI/TIA/EIA-568.1-D.

.3 Trained technicians who have successfully attended an appropriate training program and have obtained a certificate, as proof thereof shall execute the tests. Appropriate training programs include installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals) and vendor supplied certifications for their product.

.4 The test equipment shall comply with or exceed the accuracy requirements for enhanced level II and/or level III field testers (according to cabling specified) as defined in TIA-568-D; Annex I: Section I.4. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table I.4 of Annex I of TIA/EIA-568.2-D.

.5 The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The Contractor shall ensure the

Cabling Subcontractor provides proof that the interface has been calibrated within the period recommended by the vendor. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.

.6 The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests. Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*.

.7 A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. (Reference TIA-568-D; Annex I: Section I.2.2).

1.1.3. Copper Cabling Performance Test Parameters

.1 Every cabling link in the installation shall be tested for Category 6A:

Testing of all 4 pairs of the horizontal cable (as specified in this document) shall include but not be limited to the following:

.1 Wire Map including; end to end continuity, open and shorts, pair polarity
.2 Cable length
.3 Inertion Loss
.4 Propagation Delay
.5 Delay skew
.6 NEXT
.7 FEXT
.8 Return Loss
.9 PSNEXT
.10 PSFEXT
.11 AACRF
.12 AFEXT
.13 ANEXT
.14 PSAFEXT
.15 PSANEXT
.16 ACRF / ELFEXT
.17 PSACRF / PSELEFXT
.18 PSAACRF / PSAELEFXT

.2 In accordance with the field test specifications defined in ANSI/TIA-568-2.D “Commercial Balanced Twisted-Pair Telecommunications Cabling and Components Standard”. This document will be referred to as the “TIA Cat 6A Standard.”

.3 In addition to testing the “In-link” performance parameters detailed above, Alien Crosstalk testing or “Between-link’ testing shall be carried out in accordance with Section 4.7 of ANSI/TIA-1152. Alien crosstalk testing includes the PS ANEXT and PS AACR-F (Power sum alien attenuation-to-crosstalk ratio from the far end) performance parameters. The standards refer to the link-under-test for Alien Crosstalk as the disturbed link

.4 PSANEXT and PSAACRF shall meet or exceed the limits defined in Section 6 of the TIA Cat 6A Standard.

.1 Selection of disturbed (victim) links:

Installation size (No. of total links)	Sample size (No. of links to test)
3 – 33	100%
34 – 3,200	33
3,201 – 35,000	126
35,001 – 150,000	201
150,001 – 500,000	315

.2 Choose short, medium and long links equally.

.3 Selection of disturber links. Select all of the links that are in the same cable bundle and the most consistently positioned relative to the disturbed link as disturbing links.

.5 If the margin of PSANEXT and PSAACRF exceeds 5 dB for the first three short, medium and long links (nine in total), further alien crosstalk testing can be discontinued.

.6 The installed twisted-pair horizontal links shall be tested from the IDF in the telecommunications room to the telecommunication wall outlet in the work area for compliance with the “Permanent Link” performance specification as defined in the TIA Cat 6A Standard.

.7 One hundred percent of the installed cabling links must pass the requirements of the standards mentioned above. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.

.8 Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals).

.9 The test equipment (tester) shall comply with the accuracy requirements for level IIIe field testers as defined in ANSI/TIA-1152. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table 4 of ANSI/TIA-1152 (Table 4 in this TIA document also specifies the accuracy requirements for the Channel configuration).

.10 The RJ45 test plug shall fall within the values specified in ANSI/TIA-568-C Annex C for NEXT, FEXT and Return Loss.

.11 The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

.12 The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy, preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The contractor shall provide proof that the interface has been calibrated within the period recommended by the vendor. To

ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.

.13 The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests (detailed in Section 4.2.2 of ANSI/TIA-1152). Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*.

.14 A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. To which extent '*' results shall determine approval or disapproval of the element under test shall be defined in the relevant detail specification, or agreed on as a part of a contractual specification.

.15 Permanent link testing of all horizontal & backbone cables is to be completed in accordance with the follow test criteria:

.1 Wire Map including; end to end continuity, open and shorts, pair polarity

.2 Cable length

.3 Basic Link

.16 The nominal velocity of propagation (NVP) must be set specific to each cable manufacturer before testing. The portable tester shall be within the calibration period recommended by the manufacturer in order to achieve the manufacturer-specified measurement accuracy. Refer to manufacturer's test procedure.

1.1.4. Copper Cabling Test Result Documentation

.1 The following test result documentation requirements shall be applied to the copper cabling as appropriate as determined by the Region.

.2 The test result information for each link shall be recorded in the memory of the field tester upon completion of the test.

.3 The test result records saved by the tester shall be transferred into a Windows™-based database utility that allows for the maintenance, review and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered, i.e., "as saved in the tester" at the end of each test and that these results cannot be modified at a later time.

.4 A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:

.1 The identification of the link in accordance with the naming convention defined in the overall system documentation

.2 The overall Pass/Fail evaluation of the link-under-test including the Attenuation worst case margin (margin is defined as the difference between the measured value and the test limit value).

.3 The overall Pass/Fail evaluation of the link-under-test including the NEXT Headroom (overall worst case) number

.4 The date and time the test results were saved in the memory of the tester

.5 General Information shall be provided in the electronic data base containing the test result information for each link:

.1 The identification of the Region site as specified by the end-user

.2 The overall Pass/Fail evaluation of the link-under-test

.3 The name of the Standard selected to execute the stored test results

.4 The cable type and the value of the 'index of refraction' used for length calculations

.5 The date and time the test results were saved in the memory of the tester

.6 The brand name, model and serial number of the tester

.7 The revision of the tester software and the revision of the test Standards database in the tester

.6 The detailed test results data to be provided in the electronic database for each tested Copper Cable must contain the following information

.1 The identification of the link in accordance with the naming convention defined in the overall system documentation

.2 The cable type and the value of NVP used for length calculations

.3 The identification of the tester interface

.4 The test results information must contain information on each of the required test parameters that are listed in this document.

1.1.5. Warranty and Certification Requirements

.1 The Contractor shall ensure the Cabling Subcontractor provides a minimum 2-year unconditional parts and labour Warranty for all equipment & labour provisioned under this Contract, from the date of Total Performance of the Contract, for each communications cabling system.

.2 The Contractor shall ensure the cabling Subcontractor arranges for a minimum of 25-year Manufacturer's Warranty and System Performance Guarantee, from the date of Total Performance of the Contract, for each communications cabling system.

.3 Response time for warranty items shall be 24 hours. The Cabling Subcontractor may be required to repair deficient Cabling Solution components outside the Contractor's regular working hours.

.4 Provide a manufacturer warranty that the Structured Cabling Solution is installed and fully operating in accordance with this and the manufacturer specifications. A framed certificate will be acceptable.

.5 Upon request and at no additional cost to the Region, ensure the Cabling Subcontractor provides a manufacturer's technical representative to conduct an on-Site visit to ensure complete technical compliance.

.6 All documentation including the certificate must be in English, and shall be submitted to the Consultant for signed acceptance prior to their production.

2. Products

2.1. ACCEPTABLE COPPER TESTERS

2.1.1. Acceptable portable UTP test manufacturers include: HP/Agilent, OMNIScanner, Fluke DSP-4000 or Equivalent.

2.2. WARRANTY & CERTIFICATION

2.2.1. Provide to Region, system certification.

3. Execution

3.1. WARRANTY AND CERTIFICATION REQUIREMENTS

3.1.1. The Contractor shall ensure the Cabling Subcontractor forwards the Structured Cabling Solution certification request form(s) to the Region and ensure that a plaque is issued to the Region along with the Structured Cabling Solution user manual. The Contractor shall ensure the Cabling Subcontractor provides a certification number within two weeks of award of this Contract.

3.1.2. The Contractor shall ensure the Cabling Subcontractor provides letter(s) of Certification within 10 Working Days of the date of Substantial Performance of the Contract to the Consultant. This letter(s) of Certification must include the following: verification of the performance of the installed system, identification of the installation by location and project number and a copy of the warranty.

3.1.3. The Contractor shall ensure the Cabling Subcontractor forwards copies of the Structured Cabling Solution certification request for Certification form complete with certification number(s) for the Contract to the Consultant within 7 Days of the issuance of the Notice to Commence the Work.

END OF SECTION 27 08 00.00

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR COMMUNICATIONS SECTIONS.

2. Products

2.1. COPPER PATCH PANELS

2.1.1. The patch panel shall support the appropriate applications, and facilitate cross connection and inter connection using modular patch cords.

2.1.2. 482 mm (19”) rack mountable MDVO or High Density style 1U 24-port or 2U 48 Port patch panel. Refer to rack elevation detail(s) on the Drawings for correct style.

2.1.3. Minimum 50 microns of hard gold over nickel or copper on outlet contact wires.

2.1.4. Patch panels shall be suitable for rack mounting and shall incorporate integral labeling spaces for port identification. Provide blank labeling strips.

2.1.5. Provide patch panels in each rack location in sufficient quantities to terminate all horizontal cables specified with no less than 6 spare ports per patch panel to be left vacant for future use.

2.1.6. Color: Black

3. Execution

3.1.1. NOT USED

4. Execution

4.1.1. NOT USED

END OF SECTION 27 11 19.00

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR COMMUNICATIONS SECTIONS.

1.2. CABLE INSTALLATION

2. Products

2.1. NOT USED

3. Execution

3.1. PRODUCT DELIVERY REQUIREMENTS

3.1.1. The Contractor shall ensure the Cabling Subcontractor unloads materials from delivery trucks in such a manner as to protect the materials from damage. In particular, reels of cable shall not be unloaded by dropping them off the vehicle.

3.2. PROTECTING INSTALLED SYSTEMS AND CONSTRUCTION

3.2.1. The Contractor shall ensure the Cabling Subcontractor will be responsible for the assembly of above equipment/materials and protection of the above equipment and related items until Substantial Performance of the Contract. Any damage to equipment shall be the liability of the Contractor. All damage shall be repaired or at the Region's request, the equipment shall be replaced at no extra charge to the Region.

END OF SECTION 27 11 23.00

1. General

1.1. WORK INCLUDED

1.1.1. Supply and install cabling as detailed in Contract Documents. The Contractor shall ensure the Cabling Subcontractor uses pathways (installed by Electrical Subcontractor) to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point, they shall use J-hooks/cable support specified in the Contract Documents.

1.1.2. Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connectorization and future moves.

1.1.3. The Contractor shall ensure ANSI/EIA/TIA-568.2-D installation practices are followed. Install horizontal cables in accordance with manufacturer's specifications ensuring that proper installation techniques are adhered to.

1.1.4. Terminate all pairs of cable at each cable end.

1.1.5. Inform the Consultant immediately of any horizontal cable runs exceeding 90 m 295'(ft). Minimum horizontal cable run (if required) shall not be less than that specified in manufacturer's specifications.

1.1.6. The Consultant shall determine the quality of workmanship during installation. Ensure cables that have not been properly installed will be reinstalled by the Cabling Subcontractor at no additional expense to the Contract.

1.2. CABLE ROUTING

1.2.1. Make any necessary changes or additions to routing of cables, pathways to accommodate structural, mechanical, electrical and architectural conditions. Where pathways or cables are shown diagrammatically run them parallel to building columns. If it is necessary to run cables otherwise to accommodate acceptable cable lengths, written permission must be obtained from the Consultant prior to installation.

1.2.2. Any deviation from the cable routing, outlet and equipment locations shown on Drawings must be approved by the Consultant and documented on as-built drawings.

2. Products

2.1. 4-PAIR HORIZONTAL COPPER CABLE

2.1.1. Four pair, twisted pair cable consisting of #23 AWG solid conductors, formed into four individually twisted pairs and enclosed in an appropriately rated thermoplastic jacket as required by local codes. All individual conductors to be insulated with fluorinated ethylene propylene (FEP).

2.1.2. All cabling must be CSA certified and stamped accordingly

2.1.3. Cable to withstand a bend radius of 25.4 mm (1") at a temperature of -20°C ± 1°C without jacket or insulation cracking.

2.1.4. All cables shall have an outer jacket colour as identified below:

Cable Designation	Colour
Data	Blue

3. Execution

3.1. GENERAL CONDITIONS

3.1.1. When terminating copper cables remove only enough cable jacket to perform termination, untwist pairs a maximum of 13 mm (1/2") for Category 5 to 6a cables and 25 mm (1") for Category 3 cables. Any specific manufacturer's installation guidelines shall supersede the above.

3.1.2. Do not splice any cables for any reason, unless prior consent is given by the Consultant.

3.2. HORIZONTAL CABLE DISTRIBUTION

3.2.1. Provide a minimum of 3.05 m (10'-0") of slack at both ends of each cable to permit future cable relocation. Neatly coil slack in ladder tray. If ladder tray is not available ceiling space and cable supports may also be used to coil slack. For completely enclosed zone conduit distribution systems, provide 3.05 m (10'-0") of slack at the telecommunications room end only.

3.2.2. Follow proper installation and termination practices for Category 6A cables. Do not kink or exceed the cable minimum bend radius or maintain a minimum of four (4) times cable diameter as bend radii if the manufacturer specifies no bend radius.

3.2.3. All horizontal cables shall be bundled on the Telecommunications Racks using Panduit Velcro straps or Equivalent. Separate Voice, Data and fibre cables into separate distinct bundles for identification purposes where applicable.

3.2.4. Bundles shall be tie-wrapped in telecommunications rooms, at a maximum of 203 mm 8"(in) separation and shall contain no more than fifty (50) cables to eliminate any excessive stress on the cable jackets.

3.2.5. When bundling cables, 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.

3.2.6. All exposed cabling at the workstation between wall/floor-input point locations and systems furniture is to be wrapped with black split loom tubing, size and length as required to suit.

3.2.7. Route/install telecommunications cabling in systems furniture, lab casework furniture and mill work as denoted on floor plans included on Drawings.

3.2.8. Avoid scraping, denting or otherwise damaging cables before, during or after installation. Make every effort to protect all exposed cabling from other trades during construction phase until cables can be placed in final pathway. Replace damaged cables at no additional cost to the Contract.

3.2.9. Provide data cables to each outlet indicated on the drawings. The Cabling Contractor shall refer to the legends on the drawing to determine the number of cables to each outlet location.

3.2.10. Terminate test and label each cable in accordance to the parameters stated in this specification document.

3.2.11. Ground all cables and components to manufacturer's specifications and standard practices.

END OF SECTION 27 15 00.19

1. General

1.1. WORK INCLUDED

1.1.1. Supply and install cabling as detailed in Contract Documents. Use pathways provided by the electrical Subcontractor to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point they shall use J-hooks/cable support specified in this document.

1.1.2. Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. Replace damaged cables at no additional cost to the Contract.

1.1.3. Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage and connectorization.

1.1.4. Cable lengths within boxes shall be adequate to permit installation and removal of device for inspection without damage to cable or connections (minimum of 6”).

1.1.5. Cable bends shall not be greater than that recommended by the manufacturer of the cable.

1.2. CABLE ROUTING

1.2.1. Make any necessary changes or additions to routing of cables, pathways to accommodate structural, mechanical, electrical and architectural conditions. Where pathways or cables are shown diagrammatically run them parallel to building columns. If it is necessary to run cables otherwise to accommodate acceptable cable lengths, written permission must be obtained from the Consultant prior to installation.

1.2.2. Any deviation from the cable routing, outlet and equipment locations shown on drawings must be approved by the Consultant and documented on as-built drawings.

2. Products

2.1. HORIZONTAL CATV COPPER CABLE

2.1.1. All horizontal CATV cabling shall be CommScope F-6 Series (CommScope Part # 4100903/10) coaxial cable or Belden or Equivalent.

2.2. CATV CABLE CONNECTORS

2.2.1. All CATV cable connectors shall be Snap-N-Seal "F" Connectors or Equivalent.

2.2.2. The Snap-N-Seal "F" Connectors (or Equivalent) shall have the following minimum performance parameters:

.1 Permanently stamped part number and color-coded sleeves for easy identification before and after installation.

.2 Quad sealed system prevents moisture from migrating into the connection.

.3 360° radial compression provides superior RF integrity (-95dB typical, 60% bonded foil cable).

.4 1/4"x 1/4" cable preparation

.5 Connector to cable retention 40 lbs minimum

.6 Minimum return loss performance of -30dB to 1GHz.

.7 Manufactured of high quality 360 brass, cadmium plated with yellow chromate coating for maximum corrosion resistance. Plastic and O-ring providing a reliable environmentally sealed connector.

2.3. WORKSTATION OUTLETS

2.3.1. Wall Faceplate

2.3.2. All wall outlets shall utilise 2-port modular style flush-mounted faceplate adapters. Each outlet shall be equipped with the appropriate “F” Female/Female bulhead modules.

2.3.3. Coordinate colour of face plates with Consultant.

2.3.4. Approved manufacturers are as follows:

Thomas and Betts Limited
CommScope Incorporated
Or Equivalent

2.3.5. Decora Adapters

2.3.6. Communications boxes that are ganged with the electrical boxes, wall, floor or raceway outlets shall utilise 2-port Decora style adapters/inserts. Each outlet shall be equipped with the appropriate “F” Female/Female bulhead modules.

2.3.7. Coordinate colour of Decora style adapters/inserts with Consultant.

2.3.8. Approved manufacturers are as follows:

Thomas and Betts Limited
CommScope Incorporated
Or Equivalent

2.4. BLANK INSERTS

2.4.1. All unused communications ports must be installed with Blank Inserts. Blank inserts shall match faceplates.

2.4.2. All CATV cable drops shall be terminated on Snap-N-Seal "F" connectors or Equivalent within their respective Telecom Room. Coordinate with the CATV service provider, the exact termination locations and amount of slack to be left on each cable.

3. Execution

3.1. GENERAL CONDITIONS

3.1.1. When terminating coaxial cables, use only manufacturer recommended coaxial cable stripping tool to remove only enough cable jacket to perform termination.

3.1.2. Utilize only manufacturer recommended compression style tool to perform installation of Snap-N-Seal "F" connectors.

3.2. HORIZONTAL COAXIAL CABLE DISTRIBUTION

3.2.1. Provide coaxial cables to each outlet indicated on the Drawings. Refer to the legends on the Drawing to determine the number of cables to each outlet location.

3.2.2. Neatly bundle and tie-wrap all cables using Velcro tie-wraps.

3.2.3. Follow proper installation and termination practices for coaxial cables. Do not kink or exceed the cable minimum bend radius or maintain a minimum of four (4) times cable diameter as bend radii if the manufacturer specifies no bend radius.

3.2.4. When bundling coaxial cables, 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 cable geometry.

3.2.5. Each end of each coaxial cable shall be terminated with one Type F connector.

3.2.6. Verify location of coaxial backbone cable within termination room. Provide adequate cable slack for termination and to reach backbone cable tap box.

END OF SECTION 27 15 33.00

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR COMMUNICATIONS SECTIONS.

1.2. OUTLET LOCATIONS

1.2.1. Horizontal Cable outlets may be relocated prior to installation, from the location shown on the Contract Drawings, to a maximum distance of 3.05m (10'-0') without adjustment to the Contract Price.

1.3. OUTLET COVER PLATES

1.3.1. When electrical and communications receptacles are ganged together, ensure cover plates are supplied and installed by the Electrical Subcontractor, unless otherwise noted in the Contract Documents. Where communications receptacles are stand alone or separate from electrical receptacles, ensure cover plates are supplied and installed by the Cabling Subcontractor.

2. Products

2.1. EIGHT-POSITION MODULES

2.1.1. The eight- position modules must be matched appropriately with the cables to ensure that end to end vendor warranties will be applicable.

2.1.2. Eight-position modular style outlet with insulation displacement contacts for termination of all eight conductors.

2.1.3. Outlets shall be suitable for installation in faceplates at workstation locations, surface raceway, or surface mount boxes.

2.1.4. All Data and Voice modules shall have the following minimum performance parameters:

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 60 Hz for 1 minute
Insulation Resistance:	200 M minimum
Contact Resistance:	1 M per contact

2.1.5. All Horizontal 4-pair cables shall be terminated with the jack colours as described below. Where the specified copper patch panels are modular, the same jack colours shall be used at both ends of each cable:

Function	Colour	Quantity
Data	Blue	As per Drawing

2.1.6. Outlets shall be suitable for installation in faceplates at workstation locations, surface raceway, or surface mount boxes.

2.2. WORKSTATION OUTLETS

2.2.1. Refer to surface mount boxes under section 2.6.1 for systems furniture outlets.

2.2.2. Use recessed blanks for all unused ports. Blanks to match Frame colour.

2.2.3. Contractor shall verify furniture manufacturer prior to ordering.

2.3. WALL FACEPLATE

2.3.1. Frames shall be 3-Port decora style.

2.3.2. Faceplate color and type (decora/modular style) shall match electrical. Visible mounting screws to match the finish of their faceplate.

2.3.3. Use recessed blanks for all unused ports. Blanks to match frame colour.

2.3.4. Some locations on the floor plans on the Drawings may indicate a wall mount telephone. The Contractor shall provide a wall mount faceplate suitable for wall mounting a telephone set in these locations.

2.3.5. Ensure cabling Subcontractor provides all faceplates for wall boxes designated Communications use that are not ganged with electrical outlet boxes.

2.4. DECORA ADAPTERS

2.4.1. Where wall boxes for Cabling Subcontractor use are ganged with electrical outlet boxes, floor or raceway outlets shall utilise 3-port Decora style adapters/inserts. Each outlet shall be equipped with the appropriate UTP modules as indicated in this section.

2.4.2. Ensure the Cabling Subcontractor provides all communications workstation adapters/inserts for all communications outlets (ganged or single) when decora style faceplates are utilized. Ensure the Cabling Subcontractor provides decora style faceplates for all communications wall box locations where not ganged with electrical.

2.5. SURFACE MOUNT BOXES

2.5.1. All systems furniture raceways that do not have a modular furniture knockout shall utilise 2-port surface mount boxes. All furniture outlets shall have 1 data drop within a 2-port surface mounted box. The 2nd port of the surface mounted box shall include a blank insert. Each outlet shall be equipped with the appropriate UTP modules as indicated in this section.

2.6. FLOOR MONUMENT

2.6.1. Floor monuments and faceplates shall be provided under the requirement of Division 26 (Electrical). Refer to Division 26 specifications and Drawings for further information

2.6.2. Contractor to determine type of module required to suit floor monument (i.e. MDVO, Keystone, etc.)

2.6.3. Where applicable, use recessed blanks for all unused ports. Blanks to match faceplate colour.

2.7. COVER PLATES AND DECORA STYLE BLANKS

2.7.1. Ensure the Cabling Subcontractor supplies and installs a total of 20 blank Insert Plates and Cover Plates for wall / floor outlets.

2.8. BLANK INSERTS

2.8.1. All unused communications ports must be installed with Blank Inserts. For Copper Patch Panels, use Black. For workstation outlets match existing / electrical.

3. Execution

3.1. GENERAL CONDITIONS

3.1.1. When terminating copper cables remove only enough cable jacket to perform termination, untwist pairs a maximum of 13 mm (1/2") for Category 5e/6/6A cables and 25 mm (1") for Category 3 cables.

3.1.2. Provide blank filler plates for all unused modular jack positions on faceplates.

3.1.3. At the workstation end, terminate each 4-pair horizontal cable on an appropriately colored 8-position module, located in the specified style faceplate. At the telecommunications room end, terminate cables within their respective termination fields. Refer to detail drawings for further details.

3.2. WORKSTATION OUTLET ORIENTATION

3.2.1. Modular Furniture Faceplate

The orientation of the Data and Voice modules at the Workstation from the perspective of the user is as indicated below:

Data 1	Top		Data 1	Left
Data 2	Middle	or	Data 2	Middle
Voice	Bottom		Voice	Right

3.2.2. Wall Faceplate and Decora Adapters

The orientation of the Data modules at the Workstation or meeting rooms from the perspective of the user is as indicated below

Data 1	Top		Data 1	Left		Data 1	Left
Data 2	Middle	or	Data 2	Middle	or	Insert	Middle
Data 3	Bottom		Insert	Bottom		Insert	Bottom

3.2.3. Surface Boxes

The orientation of the Data and Voice modules at the Workstation from the perspective of the user is as indicated below:

Data 1	Left
Data 2	Right

3.2.4. Ensure the Cabling Subcontractor verifies, with the Consultant, the position of jacks prior to installation.

END OF SECTION 27 15 43.00

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR COMMUNICATIONS SECTIONS.

1.2. CABLE INSTALLATION

2. Products

2.1. NOT USED

3. Execution

3.1. PRODUCT DELIVERY REQUIREMENTS

3.1.1. Ensure the Cabling Subcontractor unloads materials from delivery trucks in such a manner as to protect the materials from damage. In particular, reels of cable shall not be unloaded by dropping them off the vehicle.

3.2. PROTECTING INSTALLED SYSTEMS AND CONSTRUCTION

3.2.1. Ensure the Cabling Subcontractor will be responsible for the assembly of above equipment/materials and protection of the above equipment and related items until Substantial Performance of the Contract. Any damage to equipment shall be the liability of the Contractor. All damage shall be repaired or at the Owner's request, the equipment shall be replaced at no extra charge to the Owner.

END OF SECTION 27 16 13.00

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR COMMUNICATIONS SECTIONS.

1.1.2. Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. The Cabling Contractor without any additional compensation shall replace damaged cables.

1.2. COPPER PATCH CORDS

1.2.1. All Data Patch Cords shall be connected in the Telecom Room to the Client supplied active equipment using 8 position 4 pair T568A/B : T568A/B Patch Cords.

1.2.2. The Patch Cords shall be CMR (FT4) rated and stamped accordingly and shall be consistent with the grade and manufacturer of the Data Cable that is being warranted.

2. Products

2.1. DATA PATCH CORDS

2.1.1. All Data Patch Cords shall be connected in the Telecom Room to the Owner supplied active equipment using 8 position 4 pair patch cords.

2.1.2. The Patch Cords shall be CMR (FT4) rated and stamped accordingly and shall be consistent with the grade and manufacturer of the Data Cable that is being warranted.

2.1.3. Patch cords to have stranded copper conductors (where system dictates) and designed to provide a mated-connection performance that exceeds the requirements per ANSI/TIA/EIA-568-D.

2.1.4. Patch cords assemblies to be factory assembled and not site prepared, complete with snagless boot.

2.1.5. Patch Cord requirements:

Designation	Termination	Colour	Length	Location
Data	RJ45/RJ45	Blue	7’ (ft) 2.13m	Telecom. Room
Data	RJ45/RJ45	Blue	10’ (ft) 3m	Workstation

3. Execution

3.1. UTP COPPER PATCH CORDS

3.1.1. At Telecommunications Room end, provide one (1) 7’ (ft) 2.13m patch cord for each data cable installed. Ensure Cabling Subcontractor is responsible for patching all data cabling. A patching schedule shall be provided to the Cabling Subcontractor prior to installation. Patch Cords supplied and installed must maintain the Channel Solution.

3.1.2. At workstation end, provide one (1) 10’ (ft) 3m patch cord for each data cable installed. Patch Cords supplied and installed must maintain the Channel Solution.

END OF SECTION 27 16 19.00

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.3. Section 26 05 34.00 - CONDUITS, CONDUIT FASTENERS AND FITTINGS.

1.2. REFERENCES

1.2.1. CAN/ULC-S524, Installation of Fire Alarm Systems, latest edition.

1.2.2. CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems, latest edition.

1.2.3. CAN/ULC-S537, Verification of Fire Alarm Systems, latest edition.

1.2.4. CAN/ULC-S1001, Integrated Systems Testing of Fire Protection and Life Safety Systems, latest edition.

1.2.5. CAN/ULC-S553, Standard For Installation of Smoke Alarms, latest edition.

1.2.6. OBC - Ontario Building Code – latest edition.

1.2.7. OESC – Ontario Electrical Safety Code, latest edition

1.3. SYSTEM DESCRIPTION

1.3.1. The fire alarm system and devices shall be installed according to CAN-CSA latest edition and the requirements of the local Authorities Having Jurisdiction.

1.3.2. All wiring shall be installed in conduit and to conform to the requirement of the Ontario Electrical Safety Code, latest edition or local code having jurisdiction. Provide a ground wire in all conduits.

1.3.3. Confirm the exact location of all system components with the architectural Consultant prior to roughing-in.

1.3.4. Fire alarm Subcontractor to install all devices and make final connections to fire alarm panel.

1.3.5. Ensure that the nomenclature of annunciator's identification nameplates, are verified with the Region and the Authorities Having Jurisdiction prior to ordering.

1.3.6. All work on the fire alarm system to be performed by a fire alarm technician certified by the Canadian Fire Alarm Association.

1.3.7. When the fire alarm system is complete, obtain the services of base building fire alarm manufacturer to make a complete inspection and verifications of all installed fire alarm equipment and devices.

1.3.8. Perform any changes necessary as a result of the above verification and inspection in accordance with the manufacturer's instructions.

1.3.9. On completion of the verification, inspection and testing obtain the verification certificate and inspection reports from the manufacturer and forward to the Region.

1.3.10. Fire alarm signaling devices to be installed and tested in compliance with Ontario Building Code (latest edition) section 3.2.4.20. (audibility).

.1 For speakers, set at 0.5 watt tap and modify up if required to achieve audibility. Tap setting shall not be set at or increased to cause the sound pressure level to be more than 100 dBA when measured 3m from the device.

.2 For horns with adjustable volume settings, set at mid volume and modify up if required to achieve audibility. Volume setting shall not be set at or increased to cause the sound pressure level to be more than 100 dBA when measured 3m from the device.

Audibility testing shall be performed with all walls, windows, ceilings, ceiling tiles, etc. installed in the space/area. If audibility is determined to be insufficient at time of occupancy, the Contractor shall be responsible for all costs associated with increasing the tap settings of the signalling device to achieve Ontario Building Code minimum audibility. Include for all costs in tender.

1.3.11. Ensure that all costs for the above testing, verification, inspection are included in the total Contract Price submitted by the Contractor with its bid.

1.3.12. Where the integrity of the existing life safety input and output devices are affected due to relocations, ceiling demolitions and/or re-installations onto new suspended ceiling, the Contractor shall maintain the system operation at all times. All suspension accessories required for the installation (e.g., mounting channels and frames, etc.) and verification of the system shall be included in the total Contract Price submitted by the Contractor with its bid.

1.4. REQUIREMENTS OF REGULATORY AGENCIES

1.4.1. System components shall be listed by ULC/CSA and comply with applicable provisions of the National Building Code, the Ontario Building Code, and meet requirements of the Newmarket Building Department.

1.5. SHOP DRAWINGS AND PRODUCT DATA

1.5.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.6. OPERATION AND MAINTENANCE DATA

1.6.1. Provide operation and maintenance data for fire alarm system for incorporation into the O&M (Operation and Maintenance) manual.

1.6.2. Include:

.1 Instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Technical data - illustrated parts lists with parts catalogue numbers.

.3 Copy of approved Shop Drawings with corrections completed and marks removed except review stamps.

.4 List of recommended spare parts for system.

.5 Detailed sequence of operation or operational matrix.

.6 Full fire alarm verification inspection report.

.7 CD/DVD or USB stick, containing electronic version of fire alarm passive graphic both in PDF and CAD, as part of O&M manual.

1.7. COMMISSIONING

1.7.1. Testing and commissioning of the integration of all life safety and fire protection systems shall be required. Follow the guidelines as outlined in the CAN/ULC-S1001 standard. Where applicable, the testing of the integrated systems shall include, but not limited to the following systems:

.1 Fire Alarm

.2 Mass Notification

.3 Audio/Visual

.4 Lighting Control
.5 Notification (i.e. “Fire Do Not Enter” signage, etc.)
.6 Sprinkler
.7 Water Supplies and/or Control Valves
.8 Smoke Control
.9 Hazardous Protection Monitoring
.10 Smoke Alarms

1.7.2. Fire Alarm Testing shall only be carried out on Saturdays and Sundays, or at other times coordinated with the Region and provide a minimum of five (5) Working Days advance notice prior to any testing.

2. Product

2.1. MATERIALS

2.1.1. Equipment and devices: ULC listed, labelled and supplied by single manufacturer.
2.1.2. Power supply: to CAN/ULC-S524.
2.1.3. Audible signal devices: to ULC-S525.
2.1.4. Visual signal devices: to CAN/ULC-S526.
2.1.5. Control unit: to CAN/ULC-S527.
2.1.6. Manual pull stations: to CAN/ULC-S528.
2.1.7. Thermal detectors: to CAN/ULC-S530.
2.1.8. Smoke detectors: to CAN/ULC-S529.
2.1.9. Smoke alarms: to CAN/ULC-S531.
2.1.10. Speakers: to CAN/ULC-S541.

2.2. WIRING

2.2.1. All fire alarm system wiring must be new.
2.2.2. Twisted copper conductors: 300 V CSA FAS minimum 105°C with FT4 rating and in mechanical protection i.e. EMT or flex as specified under Section 26 05 34.00 - CONDUITS, CONDUIT FASTENERS AND FITTINGS.
2.2.3. To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.
2.2.4. To signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.
2.2.5. To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.
2.2.6. To speaker circuits: twisted, shielded pairs, and in accordance with the manufacturer’s requirements.
2.2.7. To telephone circuits: twisted, shielded pairs, and in accordance with the manufacturer’s requirements.
2.2.8. Risers: twisted, shielded pairs MI cable, configured to eliminate interference and cross-talk.
2.2.9. All initiating and output circuits are to match base building fire alarm system configuration, unless otherwise shown on the Drawings.
2.2.10. All wiring between junction boxes and water flow switch, pressure switch, or supervisory switches will be in liquid tight flexible conduit.

2.3. **AUDIBLE SIGNAL DEVICES**

2.3.1. Speakers: Cone type: Recessed, 200 mm, round, ceiling mounted or surface mounted in box for unfinished areas.

.1 Fire retardant, moisture proof.

.2 Multiple taps adjustable from 0.25 to 2 W. Set at 0.5 watt tap and modify up if required to achieve audibility.

.3 Frequency response: 400 to 4000 Hz.

.4 Output sound level: 85 dB at 3 m with 1 W tap.

2.3.2. Horns: weatherproof mounting, 24 V dc, for use primarily in mechanical equipment areas, both indoor and outdoor. Horn type with compression driver, surface mounted.

.1 Corrosion, vibration and vermin resistant.

.2 Designed to broadcast high quality emergency voice communications as well as alert and alarm tone signals.

.3 Multiple taps adjustable from 2, to 15 watt tap with maximum tap output sound level of 100db at 3m.

.4 Frequency response: 400 to 4000 Hz.

.5 Available in 25 or 70Vrms.

2.4. **VISUAL ALARM SIGNAL DEVICES**

2.4.1. Strobe type: white flashing light, wall mount or ceiling mounted as per drawings.

.1 Synchronized at one flash per second.

.2 Flash tube enclosure in clear LEXAN or equivalent.

.3 “FIRE” installed red letters.

.4 Operating on 20-24 V dc.

.5 Field adjustable for 15cd or 75cd unless specified otherwise on the Drawings.

2.4.2. Designed for surface mounting on ceiling or walls as indicated on the Drawings.

2.5. **END-OF-LINE DEVICES**

2.5.1. End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.6. **ISOLATION MODULE**

2.6.1. Provide isolation modules in accordance with CAN-ULC-S524.

.1 Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an DCL-C branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the DCL segment branch.

.2 If a wire-to-wire short occurs, the isolator module shall automatically disconnect the DCL-C segment. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.

.3 The isolation module will provide a single LED that flashes to indicate the isolation module is operating and illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.7. **ANCILLARY DEVICES**

2.7.1. Remote relay unit to initiate fan shutdown, magnetic door looks and door hold open devices.

2.8. **STI STEEL WEB STOPPERS, DETECTOR COVERS**.

2.8.1. Provide STI 9600 series or equivalent detector cover for areas where sporting events or similar activities avail.

2.9. **STI STOPPER 2 & WEATHER PROOF STOPPER 2, COVERS FOR MANUAL STATIONS.**

2.9.1. Provide STI Stopper 2 1100 series or equivalent manual station covers for all vandal resistant locations identified on the electrical and architectural drawings.

2.9.2. Provide Weather Proof Stopper 2 1200 (flush mount) or 3100 (surface mount) series or equivalent manual station covers for all weather proof locations and outdoor applications identified on the electrical and architectural drawings.

2.10. **RELAY BASE, FOR FIRE DETECTORS.**

2.10.1. Provide power along with the relay base detector such that the device that is being controlled with the normally open or normally closed relay base may operate or function. Power requirements and relay condition to be determined on Site.

2.11. **MANUFACTURERS**

.1 The Contractor shall ensure all new fire alarm devices and components used are compatible with the existing base building fire alarm system, and the fire alarm system is fully functional upon Substantial Performance of the Contract.

3. **Execution**

3.1. **INSTALLATION**

3.1.1. Install systems in accordance with CAN/ULC-S524.

3.1.2. Install central control unit and connect to ac power supply.

3.1.3. Install manual alarm stations and connect to alarm circuit wiring.

3.1.4. Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts. Installation of duct type detectors will be complete with sampling tubes.

3.1.5. Connect alarm circuits to main control panel.

3.1.6. Install bells, horns and visual signal devices and connect to signalling circuits.

3.1.7. Connect signalling circuits to main control panel.

3.1.8. Install remote annunciator panels and connect to annunciator circuit wiring.

3.1.9. Install door releasing devices.

3.1.10. Install remote relay units to control fan shut down.

3.1.11. Sprinkler system: wire alarm and supervisory switches and connect to control panel.

.1 Sprinkler devices should be wired such that opening of a device will cause a trouble on an alarming device or a supervisory on a supervising device.

.2 The Contractor shall ensure that where mechanical/sprinkler Subcontractor makes revisions to the base design, electrical Subcontractor coordinates any revisions to fire

protection system directly with the mechanical/sprinkler Subcontractor at no cost to the Region and update as-built drawings accordingly.

3.1.12. Room detection system (where applicable):

.1 Install detectors. Make necessary connections between room detection panel and main fire alarm panel.

.2 Locate and install audible signals and visual alarms.

.3 Locate and install detectors under raised floor. Fasten to steel brackets approximately 300 mm above sub-floor level to clear cables and conduits.

3.1.13. Connect fire suppression systems to control panel where applicable.

3.1.14. Splices in wiring are not permitted.

3.1.15. Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and CCU (Central Control Unit), as required by equipment manufacturer.

3.1.16. Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

3.1.17. Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.

3.1.18. Install speakers and connect to speaker circuits.

3.1.19. Install smoke and smoke/CO alarm in accordance with CAN/ULC-S553.

.1 Where more than one smoke (or smoke/CO) alarm is installed within a dwelling unit, interconnect the wiring such that actuation of one smoke (or smoke/CO) alarm will cause all the smoke (or smoke/CO) alarms within the dwelling unit to sound.

3.2. FIELD QUALITY CONTROL AND COMMISSIONING

3.2.1. All fire alarm test and verification reports are to be submitted with a covering letter from the manufacturer clearly stating that there are no deficiencies with the installation prior to releasing the respective area for occupancy.

END OF SECTION