LEGEND

* Specifications prepared by consultants other than G. Bruce Stratton Architects (the “Consultant”) have been prefixed with an asterisk. These Specifications are not included under, nor governed by G. Bruce Stratton Architects’ seal.

Consultant’s Abbreviations:

GBSA G. Bruce Stratton Architects
GYP GYP Mechanical Engineers
S&A Smith and Anderson Electrical Engineers

## PART 1 - GENERAL

### 1.1. GENERAL INSTRUCTIONS

1.1.1. Comply with 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 section of the Contract Documents.

### 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, bylaws, 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. If the Contractor becomes aware of circumstances which may require a change in the Work or other directions, the Contractor shall immediately give written notice to the Consultant outlining such circumstances and request written directions. Do no work in affected area, or prevent the Consultant from properly assessing situation or evaluating change, without the Consultant’s 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 during winter months, if applicable, until the Work is completed and accepted.

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 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 area previously defined.

1.10.2. The Contractor has complete and exclusive use of the Place of the Work for performance of the Work. The Region will continue to occupy the York Region Administrative Centre during the 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 the Place 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. Execute the Work to cause minimum interference with activities in adjacent 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 Contractor may interfere, possess, obstruct or remove from use any such area or services.

**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 Local 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.

**1.16. 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. The Owner will provide security escort for the Work in locations it deems necessary.

1.16.4. 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.

1.16.5. Direct enquiries regarding security regulations to the Owner, who will advise the Contractor of any additional requirements.

1.16.6. Execute the Work taking into consideration movement of occupants.

**1.17. SECURITY CLEARANCE OF EMPLOYEES**

1.17.1. The Site is designated by the Owner as a secure location, and workers on the Site may be subject to security checks and may be required to obtain security clearance before commencing the Work.

1.17.2. Security checks shall be arranged by the Owner. Provide to the Owner, names, addresses, and consents of all of its workers and those Subcontractors employed in the Work.

1.17.3. Any worker who is unable to obtain security clearance, or who refuses to consent to such security checks, upon notice by the Consultant, is not permitted to work on the Site.

1.17.4. During course of the Work, new workers not included in original security check may likewise be subject to security check. Such new workers are not allowed on the Site until clearance is given.

1.17.5. Workers employed on the Site shall sign "Daily Register" provided, showing "IN" and "OUT" times and number of hours worked on each shift.

**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.

1.18.3. 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.

**1.19. NO SMOKING POLICY**

1.19.1. The Contractor shall ensure that its staff, Subcontractors and suppliers performing work on the Site adhere to the Region's Smoke Free Work Environment Guidelines.

**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.

1.21.3. 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. 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. VAT: Value Added Taxes.

### 1.3. CASH ALLOWANCES (NOT USED)

1.3.1. Read and conform to the General Conditions of this Contract.

1.3.2. Disbursements from Cash Allowances, if any shall be authorized by the Consultant in writing, as applicable.

1.3.3. Extend to the Owner refunds, trade and quantity discounts which may be received in purchasing under Cash Allowances, except cash discounts for prompt payment.

1.3.4. In submitting final adjustments of Cash Allowances, include duplicate, summary statements and copies of receipted invoices substantiating purchases under Cash Allowances.

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.

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 VAT), 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, if any.

1.6.2.4. waste diversion of nonhazardous demolition materials. Calculations based on weight or volume

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.

**1.7. 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 Working Days that supplemental instruction requires an amendment in the Contract Price and/or the Contract Time. If satisfied, the Consultant will issue a Contract Change Order ("CCO") for processing, or if notification has not been received within 10 Working 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. 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. 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.

1.9.2. 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, if more copies are required 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 in writing, 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 General Conditions of the Contract.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1. GENERAL INSTRUCTIONS

1.1.1. 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. SDS: 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

1.3.1. Refer to Section 01 20 00 regarding Contract modification procedures.

1.3.2. Study the Contract Documents to determine extent of Work required under each Specification Section and upon which Work under 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 Standard 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.

1.3.3. 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 ensure best arrangements of components in available space. Contact Consultant before commencing the Work in critical locations. Fabricate and erect the Work to suit field dimensions and field conditions.

1.3.4. 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 Subcontractors performing Work under related Specification Sections as to their location.

1.3.5. Pay cost of extra Work caused by, and make up time lost as result of, failure to comply with these requirements at proper time.

1.3.6. 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 by Contractor and other related information. Fabricate and erect the Work to suit field dimensions and field conditions.

1.3.7. Ensure the Contract Documents are fully coordinated with respect to architectural, structural, mechanical, electrical and other specialty requirements.

1.3.8. 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 (included with Contract Documents), 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. 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.

1.6.2. 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).

1.6.3. Chair: Contractor.

1.6.4. Include following:

1.6.4.1. Prepare agenda for meetings.

1.6.4.2. Distribute written notice of each meeting a minimum of 7 Days in advance of meeting date, stating time and place, to persons whose presence is required.

1.6.4.3. Make physical arrangements for meetings.

1.6.4.4. Record minutes and attendees; include significant proceedings and decisions.

1.6.4.5. 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.

1.6.4.6. Ensure representatives of t h e Contractor, t h e Contractor's consultants, Subcontractors and suppliers attending meetings are qualified and authorized to act on behalf of entity each represents.

1.6.4.7. Ensure relative information is available to allow meetings to be conducted efficiently.

1.6.4.8. Consultant may attend meetings to ascertain the Work is consistent with the Contract Documents.

1.6.4.9. Documents and construction p schedule.

1.6.4.10. Construction 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.

1.6.4.11. Review, approval or correction of minutes of previous meeting.

1.6.4.12. Review of Work progress since previous meeting.

1.6.4.13. Field observations, problems, conflicts.

1.6.4.14. Problems which impede Construction Progress Schedule.

1.6.4.15. Review of off-site fabrication, delivery schedules.

1.6.4.16. Review of submittals schedules.

1.6.4.17. Corrective measures and procedures to regain projected schedules.

1.6.4.18. Quality standards.

1.6.4.19. Pending changes and substitutions.

1.6.4.20. 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. Certificate of Insurance (to be provided upon Contract execution) cash flow schedule, Construction Schedule, Shop Drawing submission schedule, bonds (to be provided upon Contract execution), trade breakdown including value for close out, WSIB Certificate of Clearance (to be provided upon Contract execution , 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. The Contractor shall submit a detailed bar chart (i.e. a critical path) construction schedule with activities itemized to enable the Contractor and the Consultant to monitor progress of the Work.

1.9.2. Construction 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 high quality informative photographs in digital and hard copy formats, taken by a skilled 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 6 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 performance of the 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 having achieved Substantial Performance.

**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 reviews to review the Work for general conformance with Contract Documents, all applicable codes and the requirements of the 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. Submit following for each Product substitution proposal:

1.14.1.1. Shop Drawings, including full details.

1.14.1.2. samples.

1.14.1.3. difference in price, if any, in form of certified quotations of both selected and proposed substitutions.

1.14.2. Submit the Contractor's written acceptance of use of substituted Products and certification substituted Products:

1.14.2.1. 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.

1.14.2.2. are compatible with and inert to adjacent materials.

1.14.2.3. will not affect Contract Schedule due to delays in delivery and installation.

1.14.2.4. have been priced to include design adjustments required to accommodate substituted Products.

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 and 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 listed 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, in accordance with the General Conditions of this Contract

1.18.2. Fabrication: Do not fabricate until Shop Drawings are indicated as "REVIEWED" or "REVIEWED AS NOTED".

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 Contractor shall have a company stamp to indicate comments on Shop Drawings submitted by Subcontractors.

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 Contractor'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 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 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 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 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. 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 will 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 SDS of all hazardous materials proposed for use on the Contract.

1.22.3. In addition to submission of SDS 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 SDS 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 selection shall be 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, 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 Substantial Performance of the Contract, submit record Drawings and Specifications to the Consultant.

**1.25. AS-BUILT DRAWINGS**

1.25.1. Prior to applying for Substantial Performance of the Contract, the Consultant will provide the Contractor with electronic set of requested Drawings for as-built Drawings purposes.

1.25.2. Drawings to be provided by Consultant to the General Contractor for mark-up purposes.

1.25.3. The Contractor is responsible for:

1.25.3.1. maintaining As-Builts Drawings during progress of work, in complete sets, at the Place of the Work.

1.25.3.2. including additional changes over and above those included in any addenda, and Change Orders.

1.25.3.3. including accurate locations, depths, sizes and types of underground utilities and concealed services in the As-Built Drawings.

1.25.3.4. having changes recorded in a manner consistent with the original Drawings using minimum AutoCad software.

1.25.3.5. ensuring outline clouds and notations are removed from the Drawings.

1.25.3.6. having 1 set of As-Built Drawing prints submitted to the Consultant for review before final submission.

1.25.3.7. incorporating any review comments made by the Consultant.

1.25.3.8. resubmitting final reviewed set in following format:

1.25.3.8.1. 1 set on electronic disk.

1.25.3.8.2. 1 set of white prints.

1.25.4. Refer to Divisions 20, 21, 22, 23, 26, and 27 for additional 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 Contract 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 20, 21, 22, 23, 26, and 27 for additional 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. Comply with Division 1 requirements and documents referred to in this Section.

### 1.2. REFERENCES

1.2.1. Reference Standards:

| | | |
|---|---|---|
| 1.2.1.1. | ASTM E329-05be | 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, the OBC as amended and regulations and bylaws of other Authorities Having Jurisdiction, including latest amendments thereto; all hereafter referred to as the "**Code**".

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 (Ontario)*, Regulation 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.

1.3.3. Conform to NFPA 101 for exit requirements.

1.3.4. Conform to OFC enacted under The Fire Marshall's Act, including latest amendments.

1.3.5. Where material is designated in the Contract Documents for certain application, unless otherwise specified in the Contract Documents, that material shall conform to standards designated in OBC and in absence of a 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 provided as specified. Forward copies of all permits to the Consultant before commencing work.

1.3.7. Conform to hours of work, rates of wages paid, terms of employment and working conditions in accordance with Ontario Fair Wage Program - Labour Conditions for Industrial, Commercial and Institutional Sector Construction Contract. Comply with all requirements of the *Workplace Safety and Insurance Act, 1997,* S.O. 1997, c. 16, including payments due thereunder.

1.3.8. Apply the Ontario College of Trades and Apprenticeship Act, 2013, S.O. 2009, c. 22, including latest amendments and regulations, 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, or 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 at the Bid closing date.

1.5.2. Amendments to reference documents after the award of the Contract affecting the Contract Price shall be dealt with in accordance with the General Conditions of the Contract.

1.5.3. If requested 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 | ASTM International (formerly American Society for Testing and Materials) |
| AWI | Architectural 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 |

| | |
|---|---|
| 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 Precast/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 |
| 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 |
| 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, 1995 |
| NBFU | National Board of Fire Underwriters (USA) |
| NEMA | National Electrical Manufacturer's Association (USA) |
| NETA | International Electrical Testing Association |
| 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 |
| OAA/OGCA | Take-Over Procedures. Ontario Association of Architects |
| OBC | Ontario Building Code, "The Building Code", Ontario Regulation 350/06, including amendments thereto |
| OFC | Ontario Fire Code, "The Fire Code", Ontario Regulation 388/97, 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 Standard Specification |
| PEO | Professional Engineers of Ontario |
| SJI | Steel Joist Institute |
| SMACNA | Sheet Metal and Air Conditioning Contractors National Association |
| SSPC | Steel Structures Painting Council |
| TSSA | Technical Standards & Safety Authority |
| TTMAC | Terrazzo, Tile and Marble Association of Canada |
| ULC | Underwriters' Laboratories of Canada |
| ULI | Underwriters Laboratories (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 |
| ℄ | center line |
| CLG | ceiling |
| CO | change order |
| 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 |
| 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 |
| 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 |
| 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 center |
| MECH | mechanical |
| MHz | megahertz |
| MEZZ | mezzanine |
| min | minimum |
| misc | miscellaneous |
| mm | millimetre |
| ML | metal lath |
| 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 center |
| od | outside diameter |
| O/H | overhead |
| OPP | opposite |
| OWSJ | Open Web Steel Joist |
| oz | ounce |
| P | partition |
| Pa | Pascal |
| PA | public address system |
| P.CONC | precast concrete |
| 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 | rainwater 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 | uninterruptible power supply |
| U/S | under side |
| USgpm | gallons per minute (United States measure) |
| V | volt |
| VA | volt ampere |
| VAC | volt alternating current |
| VDC | volts direct current |
| VB | vapour barrier |
| VCT | vinyl composition tile |
| VERT | vertical |
| VEST | vestibule |
| VOC | volatile organic compound |
| 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 to:

1.12.1.1. design components of the Work of this Contract 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 20, 21, 22, 23, 26, and 27espectively.

**END OF SECTION**

PART 1 - GENERAL

**1.1. GENERAL INSTRUCTIONS**

1.1.1. Comply with 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: (NOT USED)

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 shall remain in-place unless noted otherwise.

1.2.1.5. Provide temporary dust tight partitions beyond those shown 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 Authorities Having Jurisdiction to satisfaction of the Consultant and local fire department in order to protect the property of the Owner and the Contractor 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. Handle flammable liquids in containers approved by applicable Government of Ontario Regulations.

1.2.2.5. 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 Jurisdiction.

1.2.2.6. Maintain temporary fire protection systems in operation 24 hours a Day.

1.2.2.7. Provide and maintain temporary access routes to exits, clear and visibly identified, 24 hours a day.

1.2.2.8. 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.

1.2.2.9. 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.

1.2.2.10. Provide fire protection to satisfaction of the Consultant, and to Authorities Having Jurisdiction and stipulated by the Owner. Maintain in operation 24 hours a Day.

1.2.2.11. 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.

1.2.2.12. Provide and maintain in working order, suitable 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 Contract.

1.2.2.13. 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.

1.2.2.14. Store rags and waste containing oil, grease or other flammable materials in a Government of Ontario approved metal container and remove from Site at end of each working Day.

1.2.2.15. Only fire resistant tarpaulins are permitted on Site.

1.2.2.16. Provide temporary standpipes as work proceeds in accordance with the regulations under the Occupational Health and Safety Act, if required.

1.2.2.17. In eliminating fire risks, or effectively controlling Site activities to minimize fire risk, observe following precautions as a minimum:

1.2.2.17.1. Prior to commencing work in any area, ensure workers are acquainted with the location of all fire-fighting apparatuses, are familiar with their proper use and all apparatuses are in good working order.

1.2.2.17.2. Stop all work immediately when any deficiencies in fire protection are encountered after work commences. Remedy all such deficiencies before resuming any other work.

1.2.2.18. Notify the fire department and the Consultant immediately should a fire of any nature occur whether the fire has been extinguished or not. Notify the fire department and the Consultant of any fire alarm shutdowns; notify once fire alarm has been recertified and is operational.

1.2.2.19. If the Contractor is the cause of a false alarm, it may be required to reimburse the Owner for any charges resulting from the false alarm.

1.2.2.20. Establish a logbook maintained by the Contractor which records all activity affecting the Owner’s fire alarm system. The logbook 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. Sanitary Facilities:

1.3.1.1. Existing toilet facilities may be used as directed provided they are kept clean and serviced. Repair damage to existing toilet facilities and clean before handing over the project.

1.3.1.2. Region may back charge the Contractor for additional cleaning of facilities if not kept clean.

1.3.2. Garbage Removal: Contractor shall use their own bins for garbage removal and arrange for pick-up with their own forces. Coordinate with the Owner regarding procedures.

**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 the work of other Sections. When not in use, move it as necessary to permit installation of other work. Construct and maintain scaffolding in a rigid, secure and safe manner. Remove scaffolding promptly when no longer required or remove it at end of each Day and store in secure place as advised by the Consultant or the Region.

**1.5. VEHICULAR ACCESS AND PARKING**

1.5.1. Parking for the Contractor's vehicles shall be arranged with the Owner. The Owner cannot guarantee that parking for all Contractor forces will be available. 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: Confine parking to facilities' designated parking facilities.as approved by the Owner. Do not block any streets, walkways or allow their use for parking by any construction crew or visitors except with approved specific permission from appropriate Authorities Having Jurisdiction and in accordance with stipulated standing regulations and restrictions. Minimize traffic movement and temporary closing of access streets.

**1.6. TEMPORARY CONTROLS**

1.6.1. Noise and Vibration Control: Control noise and vibration generated by the Work. Respond immediately to complaints of noise and vibration received from Owner, Authorities Having Jurisdiction or 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. 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: Products 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 an Equivalent approved by the Consultant and/or Owner) 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 renovation to building under the Contract 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 as an Equivalent. 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)", non-ferrous sheet metals based on "Brown & Sharpe Gauge", and 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 Having Jurisdiction, 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**

# Common Product Requirements Guideline

| Version | Date | Description of Revisions | Reason for Revisions |
|---|---|---|---|
| 1 | February 26, 2013 | | |
| 2 | December 14, 2020 | General Updates | |
| | | | |
| | | | |
| | | | |

NOTE:

This is a CONTROLLED Document. Any documents appearing in paper form are not controlled and should be checked against the on-line file version prior to use.

**Notice:** This Document hardcopy must be used for reference purpose only.

**The on-line copy is the current version of the document.**

**Any deviation from this document shall be approved by the Region Project Manager prior to proceeding.**

# 1 General:

## 1.1 SCOPE

1.1.1 The objective of this section is to provide guidance to the Consultant and General Contractor for the purpose of selecting products and materials that help meet the Region's sustainability objectives.

## 1.2 APPLICABILITY

1.2.1 This Building & Facilities Design Standard and Guideline shall apply to:

1.2.1.1 All projects, including new facilities and upgrades, retrofits and expansions of existing facilities <u>except</u> those projects pursuing LEED® for New Construction certification

1.2.2 Projects that are targeting LEED certification shall follow LEED requirements.

## 1.3 RELATED SECTIONS

1.3.1 Indoor Air Quality Management

1.3.2 Carpeting

## 1.4 REFERENCE STANDARDS

1.4.1 Sustainable Products Policy

1.4.2 All products covered by this Section shall be designed, manufactured, tested, installed and commissioned in accordance with Industry applicable Codes and Standards.

## 2 Products and Materials:

### 2.1 LOW EMITTING ADHESIVES AND SEALANTS (ALL TRADES/DIVISIONS):

2.1.1 All Adhesives and sealants used on the interior side of the building air barrier shall comply with the requirements of South Coast Air Quality Management District (SCAQMD) Rule #1168 Effective October 6, 2017, including the following maximum VOC content:

Table 1: SCAQMD Rule 1168 VOC Limits (select product types)

| Architectural Applications | VOC Limit (g/L less water) |
|---|---|
| Building Envelope Membrane Adhesive | 250 |
| Carpet Pad Adhesives | 50 |
| Ceramic Glass, Porcelain & Stone Tile Adhesive | 65 |
| Cove Base Adhesives | 50 |
| Dry Wall and Panel Adhesives | 50 |
| Multipurpose Construction Adhesives | 70 |
| Roofing | |
| Single Ply Roof Membrane Adhesives | 250 |
| All Other Roof Adhesives | 250 |
| Rubber Floor Adhesives | 60 |
| Structural Glazing Adhesives | 100 |
| Structural Wood Member Adhesive | 140 |
| Subfloor Adhesives | 50 |
| VCT and Asphalt Tile Adhesives | 50 |
| Wood Flooring Adhesive | 100 |
| All Other Indoor Floor Covering Adhesives | 50 |
| | |
| **Specialty Applications** | **VOC Limit (g/L less water)** |
| Contact Adhesive | 80 |
| Edge Glue Adhesive | 250 |

| | |
|---|---|
| Plastic Welding Cement | |
| ABS Welding Cement | 325 |
| ABS to PVC Transition Cement | 510 |
| CPVC Welding Cement | 490 |
| PVC Welding | 510 |
| All Other Plastic Welding Cements | 100 |
| Special Purpose Contact Adhesive | 250 |
| Top and Trim Adhesive | 250 |
| | |
| **Substrate Specific Applications** (For adhesives, adhesive bonding primers, or any other primer not regulated by the above two tables and applied to the following substrates, the following limits shall apply) | **VOC Limit (g/L less water)** |
| Metal to Metal | 30 |
| Plastic Foams | 50 |
| Porous Material (except wood) | 50 |
| Wood | 30 |
| Fiberglass | 80 |
| Reinforced Plastic Composite | 200 |
| | |
| **Sealants** | **VOC Limit (g/L less water)** |
| Architectural Applications | |
| Clear, Paintable, and Immediately Water-Resistant Sealant | 250 |
| Foam Insulation | 250 |
| Foam Sealant | 250 |
| Grout | 250 |
| Non-Staining Plumbing Putty | 250 |
| Potable Water Sealant | 250 |
| Roofing | |
| Single Ply Roof Membrane Sealant | 450 |
| All Other Roof Sealants | 300 |
| All Other Architectural Sealants | 200 |
| | |
| **Sealant Primers** | **VOC Limit (g/L less** |

| | water) |
|---|---|
| Architectural Applications | |
| Non-Porous | 250 |
| Porous | 775 |

2.2 LOW EMITTING PAINTS AND COATINGS (ALL TRADES/DIVISIONS):

2.2.1 All paints and sealants used on the interior side of the building air barrier shall comply with the most stringent requirements of South Coast Air Quality Management District (SCAQMD) Rule #1113 Effective February 5, 2016, including the following maximum VOC content:

Table 2: SCAQMD 1113 VOC Limits (select product types)

| Coating Category | VOC Limit (g/L) |
|---|---|
| Concrete-Curing Compounds | 100 |
| Flats | 50 |
| Mastic Coatings | 100 |
| Nonflat Coatings | 50 |
| Primers, Sealers and Undercoaters | 100 |
| Shellac | |
| Clear | 730 |
| Pigmented | 550 |
| Stains, Interior | 250 |
| Wood Coatings | 275 |
| Varnish | 275 |
| Sanding Sealers | 275 |
| Lacquer | 275 |

2.3 LOW EMITTING COMPOSITE WOOD AND AGRIFIBRE PRODUCTS:

2.3.1 Composite wood and agrifibre products (particleboard, medium density fibreboard, plywood, oriented strand board (OSB), wheat board, straw board, panel substrates, door cores, etc.) shall contain no added urea-formaldehyde resins.

2.4 CARPET:

2.4.1 Carpet shall meet the requirements of the Carpet and Rug Institute Green Label Plus Carpet Testing Program

2.4.2 Carpet cushion shall meet the requirements of the Carpet and Rug Institute Green Label Testing Program

2.5 NON-CARPET FINISHED FLOORING:

2.5.1 To reduce indoor air quality emissions, the following types of non-carpet finished flooring should be FloorScore certified:

2.5.1.1 vinyl sheet flooring

2.5.1.2 vinyl composition tile (VCT)

2.5.1.3 solid vinyl tile (SVT) and luxury vinyl tile (LVT)

2.5.1.4 linoleum

2.5.1.5 rubber flooring

2.5.1.6 cork flooring

2.5.1.7 hardwood, engineered and bamboo flooring

2.5.1.8 laminate flooring

2.5.1.9 polymeric flooring

2.5.1.10 wall base and related products

2.5.1.11 flooring adhesives

2.6 FOREST STEWARDSHIP COUNCIL (FSC) WOOD:

2.6.1 Where wood products are used, projects should use products certified by the Forest Stewardship Council.

2.7 RECYCLED MATERIALS:

2.7.1 Recycled content products are defined as those containing:

2.7.1.1 a minimum of 10% post-consumer content, or

2.7.1.2 a minimum of 20% pre-consumer content.

2.7.2 Projects should maximize the use of materials with recycled content.

2.8 SALVAGED MATERIALS:

2.8.1 Where feasible, projects should reuse existing materials from demolition to the maximum extent possible, including doors, door frames and hardware, cabinetry, lighting, ductwork and masonry products.

2.8.2 Where feasible, projects should consider reusing materials recovered from offsite.

2.9 RAPIDLY RENEWABLE MATERIALS:

2.9.1 Rapidly renewable materials are defined as those that harvested and replanted within 10 years, such as bamboo flooring, cotton batt insulation, linoleum flooring, wheatboard cabinetry and cork flooring.

2.9.2 Projects should consider the use of rapidly renewable materials where appropriate.

2.10 REGIONAL MATERIALS:

2.10.1 Regional materials are defined as those where at least 50% of the product meet the following requirements:

2.10.1.1 The final manufacturing location of the product is within 800km of the project site; and

2.10.1.2 The product (or component) did not leave the 800km radius surrounding the final manufacturing location (2,400km if shipped by rail or water). This includes all extraction, harvesting, recovery and processing.

2.10.1.3 The use of regional materials can reduce harmful emissions associated with product transportation.

2.10.1.4 Projects should consider using regional materials where available.

## 2.11 PRODUCT SPECIFICATION AND SELECTION

2.11.1 The following types of materials at minimum should be sourced to meet one, or preferably more, of the criteria listed in Sections 2.1 to 2.10:

2.11.1.1 concrete

2.11.1.2 masonry products

2.11.1.3 structural steel

2.11.1.4 steel framing/wall studs

2.11.1.5 sheet metal

2.11.1.6 composite wood products (plywood, MDF, etc.)

2.11.1.7 wood framing

2.11.1.8 insulation

2.11.1.9 doors

2.11.1.10 gypsum drywall

2.11.1.11 acoustic ceiling panels and suspension systems

2.11.1.12 carpet and other flooring materials

2.11.1.13 millwork

2.11.1.14 adhesives

2.11.1.15 sealants

2.11.1.16 paints

2.11.1.17 coatings

2.11.1.18 plumbing piping

2.11.1.19 valves

2.11.1.20 pumps

## 3 Documentation

3.1 Contractor shall provide product/material data sheets to the Consultant for review and approval prior to purchasing.

END OF SECTION

## PART 1 - GENERAL

### 1.1. GENERAL INSTRUCTIONS

1.1.1. Comply with 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(06) 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 (NOT USED)

### 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 so they are at least 300mm 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 the 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 the 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. 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.

1.5.1.3. 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. The Contractor is ultimately responsible for ensuring all work is completed as per the intent of the Contract Documents. Verify corrected work prior to commencing work. Execution and application of your work shall be deemed acceptance of work upon which your work depends.

1.5.2. Existing Activities, Facilities and Conditions:

1.5.2.1. The York Region Administrative Centre will remain open throughout the Work. Do not interrupt existing services, facilities and activities at the York Region Administrative Centre, 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 Ontario Building Code 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 of the Contractor for the Work, but is a precaution against oversight or error. The Contractor shall remove and replace defective and/or damaged Products at its 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 and 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 7 Days 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 surfaces. 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 in the Contract Documents, to condition better than existing conditions.

1.8.1.3. Restore any areas within the Administration Centre outside of limits of Work which are disturbed due to the Work to original condition in addition to complying with requirements of the Contract Documents.

1.8.2. Installation:

1.8.2.1. Except where specified otherwise in the Contract Documents, 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 clarification from the Consultant.

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 executed to 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.

1.8.2.9. 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. Make changes requested to comply with these requirements at no additional cost to the Owner.

1.8.2.12. If requested by the Consultant, and before their 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 7 Days. 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 required by

Consultant.

1.9.10. Properly coordinate Work of various Sections and trades. Take into consideration existing installations to ensure 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 tradespeople 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.

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, for example, 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 and 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 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. 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 09 65 00 Resilient Flooring.

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 Drawings).

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 the York Region Administrative Centre 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 products 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 shall be 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.

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. Do not apply finish to baseboards.

1.10.2.4.2. Vacuum carpet flooring using power brush equipped vacuum cleaner. Remove stains using flooring manufacturers recommended 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.

1.10.2.4.3. walls: shall be completely dusted and all marks removed. Where necessary walls shall be washed if painting is not an option.

1.10.2.4.4. ceilings.

1.10.2.4.5. window coverings.

1.10.2.4.6. doors, windows and frames.

1.10.2.4.7. exposed interior and exterior glazed surfaces.

1.10.2.4.8. hardware.

1.10.2.4.9. mechanical and electrical fixtures and equipment.

1.10.2.4.10. stainless steel, anodized aluminum, brass, bronze and other metals.

1.10.2.4.11. 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 limitations, 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, and smudges caused by Work within work areas of this Contract. Remove from decorative work, electrical and mechanical fixtures, furniture fitments, walls, ceiling and floors. 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 the Work.

1.10.2.13. Make Good any damage caused outside work area. Include doing necessary cleaning required due to the 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, Region's employees, 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 the Site. Should such contamination accidentally occur report it immediately and clean up to satisfaction of the Consultant.

1.12.1.6. Protect Work completed by various Subcontractors from other Subcontractors completing their Work.

1.12.1.7. Damaged Work shall be made good wherever possible by Section whose work is damaged but at expense of those causing damage.

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: Make Good any defects and deficiencies due to faulty materials or quality of performance that become apparent in the Work during the Warranty Period. Conform to requirements of the Contract and provide Warranty 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 for commencement, procedure and release of holdback fund. Lien period commencement, procedure and release of holdback monies will be in accordance with the Construction Act.

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 in document 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 shall be reviewed at first coordination site meeting to ensure all parties understand their responsibilities.

1.13.3. Application for Substantial Performance of the Contract: GC 5.4 of the General Conditions sets out the process to be followed when applying for Substantial Performance 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.

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 its 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. During inspection, a decision will be made by the Owner in consultation with the Consultant as to which elements must be completed at a later date due to uncontrollable circumstances such as weather, which defects must be rectified before building can be accepted and which defects are to be treated as warranty items.

1.13.7.4. 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. 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. 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 its 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. Consultant to 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. Not used.

1.14.2. Not used.

1.14.3. Pre-Start Health and Safety Review Reports (PSR): Submit all exemption documents or PSR reports prior to Substantial Performance of the Contract5 in accordance with Section 01 40 00 – Quality Requirements.

1.14.4. Product Record Documents:

1.14.4.1. Obtain from the Consultant 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 Contract; Submit “As-Built Drawings” 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 and 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. substitutions and alternatives accepted or approved by the Consultant.

1.14.4.5.4.5.3. other changes and deviations to items specified approved by the Consultant.

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: 10 Days prior to applying for Substantial Performance of the Contract, provide the Consultant with 3 sets of operating and maintenance instructions and data books 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 (Project name)". Ensure binders contain name of the Contractor and date of Substantial Performance of the Contract.

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 Contract, 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. Contractor shall note 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 |
| Rubber Base | 100 linear feet, if applicable |
| Flooring Used at the Great Hall and old Cafeteria area | 10% |
| Paint:<br>• Main wall colour (white)<br>Ceiling Paint | <br>2 gallons (not opened)<br><br>2 gallons (not opened) |
| Light Bulbs<br>• LED tubes<br>• LED Dimmable<br>• LED Bulbs for pot lights | 2 of each |

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, for example, positioning, proper side up, etc., in accordance with manufacturer's recommendations.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1. GENERAL INSTRUCTIONS

1.1.1. Comply with CCDC 2 Stipulated Price Contract - -2008 as amended by the Region.

1.1.2. Comply with Division 1 requirements and documents referred to in this Section.

### 1.2. SUMMARY

1.2.1. Section Includes: Provide demolition and salvage including but not limited to following:

1.2.1.1. selective architectural, structural, mechanical and electrical demolition to accommodate alterations.

1.2.1.2. new openings.

1.2.1.3. Items for Salvage: As noted on Drawings.

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. Demolition and removal of mechanical equipment services designated for removal on Drawings and as required by Work. Disconnecting and capping prior to authorizing removal: Division 21, Fire Suppression, Division 22, Plumbing and Division 23 Heating, Ventilating and Air Conditioning.

1.2.2.3. Disconnection and sealing off electrical services to building to be demolished: Division 26, Electrical.

1.2.2.4. Demolition and removal of electrical equipment services designated for removal on Drawings and as required by Work. Disconnecting and capping prior to authorizing removal: 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. OBC: The Ontario Building Code, 2006.

1.3.2. Definitions:

1.3.2.1. Hand Demolition: Systematic demolition of structures by workers using hand-held tools.

1.3.2.2. Mechanical Demolition: Systematic demolition of required areas using powered equipment.

1.3.2.3. Systematic Demolition: Methodical dismantling of structure piece by piece, usually carried out in reverse order of construction.

1.3.3. Reference Standards:

1.3.3.1. CSA S350-M80(03) - Code of Practice for Safety in Demolition of Structures

1.3.3.2. OPSS 1001-05 - Material Specifications for Aggregates-General

1.3.3.3.OPSS 1010-04- Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material

1.3.3.4.Gasoline Handling Act, 1980

**1.4. ADMINISTRATIVE REQUIREMENTS**

1.4.1. Pre-Demolition Meeting:

1.4.1.1. Prior to start of work, arrange for site meeting of all parties associated with work of this Section. Presided over by Consultants, meeting shall include Contractor, demolition Subcontractor, testing company's representative and structural engineer.

1.4.1.2. Review Specification for work included under this Section and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, inspection of construction to be demolished, methods to be used, sequence and quality control, Project staffing, restrictions due to environmental protection requirements and other matters affecting demolition, to permit compliance with intent of this Section. Review structural load limitations of existing structures. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays. Review and finalize protection requirements.

1.4.2. Scheduling:

1.4.2.1. Where practicable, remove or neutralize hazardous or toxic materials identified in Environmental Report before demolition begins.

1.4.2.2. Phase selective demolition as indicated on Drawings to accommodate new construction.

1.4.2.3. Demolition and removal of electrical equipment services designated for removal on Drawings and as required by Work. Disconnecting and capping prior to authorizing removal: Division 26.

**1.5. SUBMITTALS**

1.5.2. Shop Drawings:

1.5.2.1. Where required by authorities having jurisdiction, submit Shop Drawings, diagrams or details showing sequence of dismantling work and shoring of structures during demolition.

1.5.2.2. For structural elements, ensure a registered structural engineer specified herein is responsible for:

1.5.2.2.1. production and review of Shop Drawings.

1.5.2.2.2. stamping and signing each Shop Drawing and any associated calculations performed.

**1.6. QUALITY ASSURANCE**

1.6.1. Qualifications:

1.6.1.1. De-Installers:

1.6.1.1.1. Employ for this work, a demolition company having 5 years Canadian experience in this type of work satisfactory to Consultant. If requested, submit proof of experience. Employ a full time professional structural engineer registered in Province of Ontario to prepare plan of action, engineer temporary shoring, bracing. Inspect this work during demolition, fabrication and erection of shoring and bracing. Provide site administration and inspection of work of this Section.

1.6.1.1.2. Use skilled personnel having substantial experience in careful removal handling and storing of heritage materials and regular construction components, items and equipment listed on Drawings and/or designated on site to be re-used elsewhere on Project or stored in location required.

1.6.1.2. Licensed Professionals: Employ a full time professional structural engineer carrying minimum $2,000,000.00 professional liability insurance and is registered in the Province of Ontario.

1.6.2. Mock-Ups: When and where required, remove materials indicated to assess conditions and to confirm removal methodology and accuracy of cut locations findings.

**1.7. SITE CONDITIONS**

1.7.1. Ambient Conditions:

1.7.1.1. Demolition performed on this Project in areas which may be partially occupied. Take care and provisions for protection of workers on site and occupants during progress of work.

1.7.1.2. Maintain Access Road to Buildings: Do not disturb existing temporary fencing. Maintain construction traffic reasonable distance away from fence line. Repair damage which is result of Work of this Contract.

1.7.1.3. Do not close or obstruct roads, streets, sidewalks, passageways without permits. Do not place or store materials in streets or passageways. Conduct operations with minimum interference with roads, streets, driveways and passageways.

**PART 2 - PRODUCTS**

**2.1. MATERIALS**

2.1.1. Description:

2.1.1.1. Regulatory Requirements:

2.1.1.1.1. Conform to The Occupational Health and Safety Act and Regulation for Construction Projects

2.1.1.1.2. Conform to OBC, especially Division C, Part 1, Article 1.2.2.3 as applicable.

2.1.1.1.3. Conform to Fire Code, Regulation under Fire Marshal Act especially Part 8.

2.1.1.1.4. Conform to requirements of Section 01 50 00 in particular, Article on engineering requirements for Temporary Construction.

2.1.2. Provide materials necessary for temporary bracing and shoring. On completion, remove temporary materials from site.

## PART 3 - EXECUTION

### 3.1. EXAMINATION

3.1.1. Preliminary Survey: Refer to pertinent architectural, structural, mechanical and electrical drawings contained in the tender documents for items to be demolished and removed from the site.

3.1.1.1. Before commencing demolition operations, examine site and when requested, provide engineering survey to determine type of construction, condition of structure and site conditions.

3.1.1.2. Assess potential effect of removal of any part or parts on remainder of structure before such part(s) are removed.

3.1.1.3. Assess effects of demolition on adjacent properties and consider need for underpinning, shoring and/or bracing.

3.1.1.4. Investigate for following conditions:

3.1.1.4.1. load-bearing walls and floors.

3.1.1.4.2. structure suspended from another.

3.1.1.4.3. effects of soils, water, lateral pressures on retaining or foundations walls.

3.1.1.4.4. presence of tanks, wells, other piping systems.

3.1.1.4.5. presence of hazardous materials.

3.1.1.5. After determining demolition methods, determine area of possible vibration. Carefully inspect beyond those adjacent areas. List potential damage areas and photograph each for record purposes before starting work.

3.1.2. Existing Services:

3.1.2.1. If applicable, notify Municipality to cut-off, remove and cap Municipal services. Verify services are cut off and properly capped before commencing associated or effected demolition. Cap and cover catch basins outside the building during the work of this Section. Do not allow demolition debris into the drains.

3.1.2.2. Provide and maintain temporary services required during demolition to satisfaction of authorities having jurisdiction, fire departments and utility companies.

3.1.2.3. Verify prior to commencement work of this Section that disconnection and capping of mechanical services have been carried out under Divisions 21, 22 and 23 in accordance with requirements of local authority having jurisdiction. Make sure Natural gas supply lines are removed by Gas Company or by qualified tradesmen in accordance with Gas Company instructions. Removal and disposal of other existing underground services and mechanical equipment shall be by Divisions 21, 22 and 23.

3.1.2.4. If applicable, contact Electrical Department of local authority and tour site with them. Disconnect and seal electrical power lines and communications cables entering buildings to be demolished. Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.

### 3.2. PREPARATION

3.2.1. Protection of In-Place Conditions:

3.2.1.1. Post danger signs conspicuously around area of work warning that it is a construction site.

3.2.1.2. Provide fire extinguishers acceptable to fire prevention authorities in locations and of type suitable to enable personnel to deal with fire occurring during progress of work.

**3.3. APPLICATION**

3.3.1. Restrictions:

3.3.1.1. Restrict demolition activities between hours of 7:30 a.m. and 5:00 p.m., Monday through Friday.

3.3.1.2. Following methods of demolition will not be permitted in work of this Contract:

3.3.1.2.1. Use of rapid progress failure methods (explosives).

3.3.1.2.2. Mechanical method of demolition whereby wrecking is accomplished by smashing walls or floors with heavy weight suspended by cable from boom or hoist or where masonry walls are collapsed using power shovel, tractor or other mechanical contrivance.

3.3.2. Demolition action plans may indicate only general scope of work to be demolished and removed. It is Contractor's sole responsibility to determine exact extent of demolition required. Contractor may not rely solely on Drawings to limit scope of selective demolition work required. Review site conditions and assess exact scope of demolition and removal.

3.3.3. Examine and review existing conditions prior to starting demolition. Initially perform demolition only in selected and designated test areas prior to proceeding full scale demolition work. Obtain approval on technique of demolition in test areas from Consultant. Only after approval, proceed in other areas.

3.3.4. Materials and debris shall not be stacked in building to extent that overloading of any part of structure will occur.

3.3.5. At end of each Day's work leave work in safe condition ensuring no parts of structure are in danger of collapsing.

3.3.6. Demolition:

3.3.6.1. Ensure demolition work is supervised by structural engineer licensed to practice in Province of Ontario at all times.

3.3.6.2. Carry out demolition in accordance with CSA S350-M. Demolish structure and remove materials from site. Use hand tools or pneumatic or hydraulic equipment. Do not use swinging apparatus or explosives. Adhere to manufacturer's recommendations in use of hand held tools while conforming to the Occupational Health and Safety Act requirements. Lower demolition materials and debris through chutes. Do not create falling materials hazard.

3.3.6.3. Investigate nature and condition of suspended concrete slabs, condition and position of reinforcement. Follow Recommendations for Demolition of Structures, Appendix A of CSA S350-M. Consult professional engineer qualified to practice in Ontario and qualified with this type of construction for method and sequence of demolition if structure is of post-tensioned construction to avoid uncontrollable failure

3.3.6.4. Remove all mechanical and electrical items indicated to be removed.

3.3.6.5. Demolish and remove interior partitions, walls, ceilings, flooring down to concrete substrate, except those specified and/or indicated to remain.

3.3.6.6. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.3.6.7. Keep work wetted down to minimize dust.

3.3.6.8. Minimize noise. Avoid use of noisy machinery outside working hours.

3.3.6.9. Provide protection around floor and/or roof openings.

3.3.6.10. Upon completion of demolition work, level and clear site or prevent access to excavations by means of fences or hoardings.

3.3.6.11. Protect from weather parts of adjoining structures not previously exposed.

3.3.6.12. Firestopping and Smoke Seal: In event work of this Section impacts on integrity of fire separations, ensure trade performing firestopping is notified.

3.3.7. Relocation of Salvaged Items:

3.3.7.1 Components of historical value, i.e. cornerstones and their contents, commemorative plaques, tablets and similar objects remain property of Owner. Store in areas designated by Owner.

3.3.7.2 Carefully remove, store, protect and re-install where applicable existing materials and equipment noted on Drawings to be retained and relocated. Relocate items to be retained and store them in areas directed by Consultant. In addition to items indicated on Drawings, Owner still reserves the right to retain any items or materials.

3.3.8. Except as indicated on Drawings or designated on site by Consultant, materials forming permanent part of structure being demolished shall become property of this Section. Remove from site.

3.3.9. Coordinate with Mechanical and Electrical respectively for removal, relocation and reinstallation of mechanical and electrical items.

3.3.10. In event of unexpected discovery of buried fuel or other tanks, do no further work and immediately report discovery, orally and in writing to Consultant. Consultant will authorize remedial work, if any, in writing. Do such remedial work, as addition to Contract.

3.3.11. Remove electrical equipment scheduled for removal on Drawings and as required by Work.

**3.4. SITE QUALITY CONTROL**

3.4.1. Site Tests and Inspections:

3.4.1.1. Structural Inspection: Ensure a registered structural engineer specified herein inspects work of this Section during demolition.

**3.5. CLEANING**

3.5.1. Waste Management:

3.5.1.1. Clear away dirt, rubbish and loose litter resulting from work of this Section, minimum daily. Keep dust to a minimum. When necessary and practical demolition works shall be sprayed periodically with water to reduce dust. Wet down debris from time to time to control dust. Maintain roadways, lanes and street sidewalks in the vicinity of the premises safe and clear.

3.5.1.2. Selling or burning of materials on site is not permitted.

3.5.1.3. Conform to requirements of municipality's Works Department regarding disposal of waste materials.

3.5.1.4. Materials prohibited from municipality waste management facilities shall be removed from site and dispose of at recycling companies specializing in recyclable materials.

3.5.1.5. Excavated material including contaminated excavated material shall be removed from site and dispose of to requirements of authorities having jurisdiction without any additional cost to Owner.

3.5.1.6. Any additional materials prohibited from waste management facilities shall be removed from site and dispose of to requirements of authorities having jurisdiction without any additional cost to Owner.

**3.6. PROTECTION**

3.6.1. Do not interfere with use and activities of occupants where applicable and adjacent buildings. Maintain free and safe passage to and from buildings. Maintain integrity of existing fire exits.

3.6.2. Protect existing adjacent work against damages which might occur from falling debris or other causes due to work of this Section.

3.6.3. Provide, erect and maintain required hoarding, sidewalk sheds if applicable, catch platforms, lights and other protection around site before commencing work. Maintain such areas free of snow, ice, mud, water and debris. Lighting levels shall be equal to that prior to erection.

3.6.4. Provide flagmen where necessary or appropriate to provide effective and safe access to site to vehicular traffic and protection to pedestrian traffic.

3.6.5. Ensure scaffolds, ladders, equipment and other such equipment are not accessible to public. Protect with adequate fencing or remove and dismantle at end of each Day or when no longer required.

3.6.6. Do not interfere with use and activities of adjacent buildings. Maintain free and safe passage to and from buildings.

3.6.7. Where necessary to seal fire exits of adjoining or adjacent buildings, provide other exits in compliance with applicable fire safety and building regulations.

3.6.8. Where demolition operations prevent normal access to adjacent properties, provide and maintain suitable alternative access.

3.6.9. If at any time safety of adjacent buildings appear to be endangered, cease operations and notify Consultant; take precautions to support buildings; do not resume operations until permission is granted by Consultant.

3.6.10. If Consultant considers additional bracing and shoring necessary to safeguard and prevent such movement or settlement, install bracing or shoring upon Consultant's orders. Should Contractor fail to comply promptly with such request, such bracing or shoring may be placed by Consultant at Contractor's expense.

3.6.11. Take precautions to guard against movement, settlement or collapse of adjacent services, sidewalks, driveways, or trees. Be liable for such movement, settlement or collapse caused by failure to take necessary precautions. Repair promptly such damage when ordered.

3.6.12. Erect and maintain partitions as required to prevent spread of dust, fumes and smoke to other parts of building. Maintain fire exits from site. On completion, remove partitions and Make Good surfaces to match adjacent surfaces of building.

3.6.13. Before starting demolition, ensure required dust-tight partitions have been installed where necessary.

**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 polished concrete floor finishing including but not limited to following:

1.2.1.1. polished concrete floor finishing system consisting of:

1.2.1.1.1. surface preparation.

1.2.1.1.2. application of clear, colourless, liquid concrete hardener and densifier.

1.2.1.1.3. grinding and polishing floor to desired finish.

1.2.1.1.4. application of water-based concrete enhancer.

1.2.2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:

1.2.2.1. Filling and sealing of sawcut joints in concrete slab: Section 03 35 13, Concrete Floor Finishing.

### 1.3. REFERENCES

1.3.1. Abbreviations and Acronyms:

1.3.1.1. ADA: Americans with Disabilities Act; www.ada.gov.

1.3.2. Reference Standards:

1.3.2.1. ASTM C1028-07e1 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Stone by the Horizontal Dynamometer Pull-Meter Method

1.3.2.2. ASTM F609-05 - Standard Test Method for Using a Horizontal Pull Slipmeter (HPS)

### 1.4. ADMINISTRATIVE REQUIREMENTS

1.4.1. Preinstallation Meetings: Arrange preinstallation meeting 1 week prior to commencing work with all parties associated with trade as designated in Contract Documents or as requested by Consultant. Presided over by Contractor, include Consultant who may attend, Subcontractor performing work of this trade, Owner’s representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade 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, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.

**1.5. SUBMITTALS**

1.5.1. Product Data:

1.5.1.1. Submit manufacturer's literature, data sheets for typical material provided under this Section for Project. Submit 3 copies of detailed instructions for maintaining, preserving and keeping materials clean and safe. Provide adequate notice of maintenance practices or materials detrimental to specified materials.

1.5.1.2. Submit manufacturer's recommended installation instructions which when approved by Consultant will become basis for accepting or rejecting completed Work.

**1.6. QUALITY ASSURANCE**

1.6.1. Qualifications:

1.6.1.1. Installers: Provide work of this Section executed by competent installers with at least ten (10) completed projects of 1000 sq.ft or greater in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

1.6.2. Mock-Ups: Construct minimum 10 $m^2$ (100 sq ft) mock-up sample at Project location designated by Consultant for acceptance. Once accepted, sample remains part of finished work and used as a quality reference standard for balance of Project.

**1.7. DELIVERY, STORAGE AND HANDLING**

1.7.1. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

1.7.2. Storage and Handling Requirements:

1.7.2.1. Store materials in a clean dry area in accordance with manufacturer's instructions.

1.7.2.2. Keep Products from freezing.

1.7.2.3. Avoid direct contact with this Product as it may cause mild to moderate irritation of eyes and/or skin.

1.7.2.4. Protect materials during handling and application to prevent damage or contamination.

**1.8. SITE CONDITIONS**

1.8.1. Ambient Conditions:

1.8.1.1. Do not apply Product when air, surface, or material temperatures are expected to fall below 4 deg C (40 deg F) within 4 hours of expected application.

1.8.1.2. Do not apply to frozen concrete.

1.8.1.3. Do not use on highly dense or non-porous surfaces.

1.8.1.4. Limit and control damage from excessive dust caused by grinding/polishing procedure.

1.8.1.5. Properly dispose of collected dry dust from polishing.

**1.9. EXTENDED WARRANTY**

1.9.1. Manufacturer Warranty: Extended Warranty of this work to be for a period of 10 years against defects and/or deficiencies over and above the two (2) year warranty required in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner. Defects include but are not limited to; bond failure and extensive sheen fading.

**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. W.R. Meadows of Canada; www.wrmeadows.com

**2.2. MATERIALS**

2.2.1. Concrete Densifier: Finish exceeding ADA recommendations for wet and dry surfaces tested in accordance ASTM C1028 for coefficient of friction, “Liqui-Hard® Concrete Densifier and Chemical Hardener” by W.R. Meadows of Canada.

2.2.2. Concrete Enhancer: Water-based, synthetic polymer concrete floor enhancer, “Bellatrix” by W.R. Meadows of Canada.

2.2.3. Water: Potable water.

**2.3. EQUIPMENT**

2.3.1. Use following grinding/polishing equipment:

2.3.1.1. Three-head counter rotating variable speed floor grinding machine.

2.3.1.2. Dust extraction system and pre-separator.

2.3.1.3. 75 kw MQ power generator or equivalent.

2.3.2. Ensure grinding/polishing equipment possess at least 775 lb of head pressure.

2.3.3. Edge Grinding/Polishing: Use a hand grinder with dust extraction equipment

2.3.4. Diamond Grinding Segments: Metal bonds: 40, 60, 80 and 150 grit.

2.3.5. Diamond Polishing Pads: Resin bonds: 100, 200, 400, 800, 1500, and 3000 grit.

2.3.6. Grinding Pads for Edges: Resin bonds: 40, 60, 80, 100, 200, 400, 800, 1500, and 3000 grit.

2.3.7. Equipment used for densifying and cleaning floor after grinding/polishing procedure has been performed:

2.3.7.1. Tennant ride-on auto-scrubber or equivalent with a head pressure of 150 lb.

2.3.7.2. Follow auto-scrubber’s manual for cleaning instructions after densifying and conditioning floor.

2.3.7.3. Do not allow densifier to remain inside auto-scrubber after densifying.

## 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. PREPARATION

3.2.1. Protection of In-Place Conditions: Protect adjacent surfaces not designated to receive treatment.

3.2.2. Surface Preparation:

3.2.2.1. Clean and prepare surfaces to receive treatment in accordance with manufacturer's instructions, ensuring stains, oil, grease, form release agents, dust and dirt are removed prior to application.

3.2.2.2. Ensure concrete is a minimum of 28 Days old.

### 3.3. APPLICATION

3.3.1. Level 1 - Satin Finish: Provide “Induroshine PDS-1” by W.R. Meadows of Canada ensuring applicator follows applicable procedures incorporating grinding plates in following order:

3.3.1.1. Verify floor is clean and dry prior to polishing procedure.

3.3.1.2. Inspects and verifies floor does not have curled joints, large cracks, spalling or lippage. If lippage or curled joints are present, refer to manufacturer for corrective procedures.

3.3.1.3. Using 80 grit metal bond grinding segment, grind floor surface at a rate of 46.5 $m^2$/hr (500 sq ft/hr). Vacuum surface to remove loose particulates.

3.3.1.4. Using 150 grit metal bond grinding segment, grind floor surface at a rate of 55.7 $m^2$/hr (600 sq ft/hr). Vacuum surface to remove loose particulates.

3.3.1.5. Flood surface with concrete densifier and scrub into floor for 45 minutes, ensuring no puddling of densifier occurs.

3.3.1.6. Squeegee off excess material.

3.3.1.7. Wait 24 hours.

3.3.1.8. Verify floor is dry and clear of debris prior to continuation of polishing procedure.

3.3.1.9. Using 100 grit resin bond polishing segment, grind floor surface at a rate of 55.7 $m^2$/hr (600 sq ft/hr). If scratches from previous grit are still apparent, decrease rate of grinding by 9.3 $m^2$ (100 sq ft) until scratches are removed. Vacuum surface to remove loose particulates.

3.3.1.10. Using 200 grit resin bond polishing segment, grind floor surface at a rate of 65 $m^2$/hr (700 sq ft/hr). If scratches from previous grit are still apparent, decrease rate of grinding by 9.3 $m^2$ (100 sq ft) until scratches are removed. Vacuum surface to remove loose particulates.

3.3.1.11. Using 400 grit resin bond polishing segment, grind floor surface at a rate of 65 $m^2$/hr (700 sq ft/hr). If scratches from previous grit are still apparent, decrease rate of grinding by 9.3 $m^2$ (100 sq ft) until scratches are removed. Vacuum surface to remove loose particulates.

3.3.1.12. Using 800 grit resin bond polishing segment, grind floor surface at a rate of 93 $m^2$/hr (1000 sq ft/hr). If scratches from previous grit are still apparent, decrease rate of grinding by 9.3 $m^2$ (100 sq ft) until scratches are removed. Vacuum surface to remove loose particulates.

3.3.1.13. Using auto-scrubber, clean floor thoroughly per manufacturer's instructions with a white non- woven pad. Replace pads approximately every 2790 $m^2$ (30,000 sq ft).

3.3.2. Concrete Enhancer:

3.3.2.1. Allow 24 hours before proceeding with concrete enhancer application.

3.3.2.2. Apply concrete enhancer, undiluted, according to manufacturer's instructions.

3.3.2.3. Spray concrete enhancer using industrial sprayer delivering 0.76 l/s (1/10th gal/min).

3.3.2.4. Pre-wet micro-fiber applicator with concrete enhancer prior to use.

3.3.2.5. Uniformly spread concrete enhancer with a micro-fiber applicator, ensuring Product is not allowed to dry before spreading is complete.

3.3.2.6. Allow concrete enhancer to set up for 2 hours, then burnish with a 3000 grit diamond pad at 2000 RPM.

3.3.2.7. For optimum performance, apply a second coat at a 90° (right) angle to first coat, after first coat is thoroughly dry.

**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 Consultant at no cost to Owner.

**3.5. PROTECTION**

3.5.1. Keep surface dry for a minimum of 48 hours after application.

3.5.2. Allow 72 hours before heavy traffic is allowed.

**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. V erification 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 (SS1): Corian Silver Birch

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: t h e 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 m² (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: the 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 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 Type:

2.2.4.1. Tempered Laminated Glass (TLGL): Clear transparent laminated tempered glass conforming to ASTM C1172, Kind LT and meeting requirements of ANSI Z97.1, minimum two layers 4mm thick with; clear PVB interlayer of 1.5 mm (0.060") thickness in between.

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: the 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 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**

it

## 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: t h e 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 24”x24” Aftermath II- Aftermath II 03026 Chambray 23511 by Tarkett. 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/Transition Strips: There are a variety of situations where two different flooring finish materials meet requiring a transition strip as per the following:

2.1.5.1. Transition between carpet tile and porcelain tile: Supply and install Schluter Schiene profile in stainless steel (brushed stainless steel 304) where carpet and porcelain tile meet.

2.1.5.2. Transition between polished concrete and/or vinyl floor and porcelain tile and/or carpet tile: Supply and installSchluter -Reno (-TK/-U/-RAMP/-k or V depending on the slope) in stainless steel (brushed stainless steel 304) in all locations where polished concrete meets with either porcelain tiles and/or carpet tile.

NOTE: ALL TRANSITIONS BETWEEN DIFFERING FLOOR MATERIALS ARE INTENDED TO HAVE A STAINLESS STEEL (BRUSHED STAINLESS STEEL 304) TRANSITION STRIP SELECTED FROM SCHLUTERS SYSTEMS PRODUCTS AS PER THE ABOVE. FOLLOW SCHLUTER INSTALLATION GUIDELINES.

2.1.6. Resilient Base (RB): 3 mm thick x 100 mm 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. Note base is to be toeless.

2.1.6.1. Flooring material to extend 102 mm onto wall surface.

**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 $CO_2$ 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) Colour name: Wedding White Finish: Eggshell

2.2.3.2. Doors and Frames Paint PT2:

2.2.3.2.1. Manufacturer: Dulux PPG Color: 1OYY 54/034(A1782) Colour name: Roma Haze Finish: Semi-Gloss

2.2.3.3. Accent Paint PT3:

2.2.3.3.1. Manufacturer: Dulux PPG Colour: #90BG 17/090 Colour name: Connecticut Blue Finish: Eggshell

2.2.3.4. GWB Ceiling Paint PT4:

2.2.3.4.1. Manufacturer: Benjamin Moore Ceiling Paint Colour: 2126-70 Colour name: Chalk White Finish: Flat or Equivalent.

2.2.3.5. Additional Field Colour PT5:

2.2.3.5.1. Manufacturer: Dulux PPG Colour to Architect's later selection

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

.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 WORK INCLUDED

.1 Provide a complete automatic sprinkler system, including all necessary labour services, products, materials and equipment as shown on the Drawings and as specified herein. Products, materials and equipment shall include, but not necessarily be limited to, the following:

.1 Piping and fittings.

.2 Valves.

.3 Hydraulic piping design and calculations.

.4 Sprinkler heads.

.5 Sprinkler cabinets.

.6 Supervisory devices.

.7 Hydrant water flow tests required for hydraulic design.

### 1.2 REFERENCE STANDARDS

.1 Provide all work in accordance with the latest requirements of NFPA 13, local codes and all authorities having jurisdiction.

.2 Provide materials that are ULC listed and approved.

### 1.3 SUBMITTALS

.1 Prior to installation, submit minimum ten (10) copies of the working drawings, hydraulic design and calculations to all authorities having jurisdiction. All hydraulic design and calculations shall be sealed by a professional engineer. Assume any additional costs that may be incurred to modify or complete the system should the authorities having jurisdiction require changes. Any and all costs pertaining to approval shall be borne by the Contractor.

.2 Submit Drawings to the Consultant after review by all authorities having jurisdiction including comments received.

.3 Provide shop drawings for all sprinkler hardware including heads, alarm valves and trim, valves.

1.4 SAMPLES

.1 Provide samples of each type of sprinkler head and accompanying escutcheons.

.2 Provide samples of sprinkler head guards.

**PART 2 - PRODUCTS**

2.1 PIPE AND FITTINGS

.1 Provide pipe and fittings of good quality consistent with the respective manufacturer, devoid of any defects and compatible with required system working pressure.

.2 All sprinkler piping shall be rigid black steel pipe, including piping connections to sprinkler heads. Flexible sprinkler drops are not permitted on sprinkler head connections.

.3 Pipe sizes up to 150 mm (6") shall be Schedule 40 black steel pipe conforming to ASTM standards. Thin wall piping conforming to ASTM standards is acceptable when used with rolled groove fittings for plain end pipe.

.4 Pipe sizes 200 mm (8") and over shall be Schedule 30 black steel pipe conforming to ASTM standards.

.5 Connections shall be screwed for piping 65 mm (2-1/2") and under. Connections for piping over 65 mm (2-1/2") may be screwed, welded (when approved by local authorities) or joined by means of Victaulic couplings (when approved by local authorities and performed to NFPA and IAO standards).

.6 Victaulic types fittings shall only be used where piping is accessible.

2.2 SPRINKLER HEADS

.1 Provide ULC approved sprinkler heads:

.1 In finished ceilings, unless otherwise indicated, chrome plated semi-recessed liquid filled pendant heads with chrome plated or painted escutcheons.

.2 In finished ceilings, where specifically indicated, fully recessed sprinkler heads (flush type) with painted or stainless steel coverplates.

.3 In unfinished areas, (such as mechanical rooms, garage, etc.) pendant or upright bronze sprinkler heads.

.2 Provide wire guards to protect sprinkler heads in all mechanical, electrical and elevator machine rooms, and in any area where heads may be damaged.

.3 Provide high temperature sprinkler heads in electric rooms, elevator machine rooms, diesel generator rooms, boiler rooms, and in all locations where sprinkler heads are located close to heating coils, unit heaters, high-intensity lighting or other hot equipment.

.4 Provide a metal cabinet with spare sprinkler heads of each type, 5 spare wrenches, keys and labels. Locate the cabinet in an accessible location in the 4th floor mechanical room.

.5 Rooms or spaces having dropped ceilings that are open to the surrounding areas shall have sprinkler coverage provided both above and below the dropped ceiling as required by NFPA 13. The Drawings indicate only the sprinkler heads to be installed below the dropped ceiling areas. Provide sprinkler coverage above the dropped ceilings in accordance with NFPA 13.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

.1 Piping and Fittings

.1 Install piping and fittings, including all necessary hangers and supports, in accordance with NFPA and IAO regulations, codes and all authorities having jurisdiction.

.2 Flush the piping system until all foreign material has been removed. Provide a certificate stating that proper flushing has been performed.

.3 Provide a system test for two (2) hours at 1780 kPA (250 psi) without any pressure loss. If leaks occur, they shall be repaired and the system retested. Provide a certificate stating that the hydrostatic test has been carried out to the satisfaction of all authorities having jurisdiction.

.4 In areas with floating ceilings or with ceiling projections, sprinkler piping shall be concealed behind adjacent walls, ceiling spaces, structural elements, etc. so as not to be visible. All piping drops for these areas shall be concealed in such a manner. Horizontal piping serving sprinkler heads shall be installed at low level as close to the top of the floating ceiling or ceiling projection as possible so as not to be visible.

### 3.2 PERMITS AND INSPECTIONS

.1 Apply and pay for all necessary permits and inspections required by authorities having jurisdiction.

### 3.3 HYDRAULIC DESIGN CRITERIA

.1 Provide hydraulically designed system in accordance with NFPA 13 standards.

.2 Provide the hydraulic design and piping calculations necessary for a complete sprinkler system.

.3 Hazard classification shall be to NFPA 13 (IAO G13) standards:

.1 Office areas - light hazard.

.4 Provide and install the required number of sprinkler heads and all necessary components as approved by all codes and all governing authorities.

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 <u>Mechanical Contractor.</u> 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”<br>DIAMETER: 1-7/16” |
| 12-32 | CONNECTION: ¾”, HEIGHT: 7”<br>DIAMETER: 1-7/16” |
| 33-60 | CONNECTION: 1”, HEIGHT: , 7-3/8”<br>DIAMETER: 2-3/16” |
| 61-113 | CONNECTION: 1-1/4”, HEIGHT:10-13/16”<br>DIAMETER: 2-116” |
| 114-154 | CONNECTION: 1-1/2”, HEIGHT: 1-1/2”<br>DIAMETER: 3-5/16” |
| 155-330 | CONNECTION: 2”, HEIGHT: 14-7/8”<br>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)<br>Kitz #64 | Iron body, flanged, solid wedge disc, O.S.&Y. bronze trim, RS 200 psi CWP. (465-1/2)<br>Kitz#72<br>Toyo #421A |
| Domestic | Copper | Globe | Bronze, soldered, renewable teflon disc, 200 psi CWP. (1310)<br>Kitz#10<br>Toyo #222 | Iron body, flanged O.S.&Y., bronze trim, 200 psi CWP. (351)<br>Kitz #76<br>Toyo#400A |
| Domestic | Copper | Ball (*) | Kitz#69AMLL<br>Toyo#5049S<br>MAS B3ZSS<br>* 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.<br>4" & Less: lock lever handles.<br>6" & greater: gear operator with handwheel (55-D4E)<br>Kitz 6122EL (Lever)<br>Kitz 6122EG ( Gear)<br>Toyo 918BESL ( Lever)<br>Toyo 918BESG ( Gear)<br>Demco NE Series<br>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.<br><br>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.<br><br>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 Filter sizes have been standardized for York Region stocking of replacement filters. Provide filter sizes as indicated in the HORIONTAL FAN COIL UNIT SCHEDULE.

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 <u>all</u> 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 rigid 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 rigid supply air ductwork within concealed ceiling spaces and shafts |
| Supply Air Duct - Rectangular | D-2 | 25 (1) | All rigid supply air 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 acoustic duct lining and accessories.

1.2 REFERENCE STANDARDS

.1 Carry out work in accordance with recommendations of ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers).

PART 2 - PRODUCTS

2.1 DUCT LINER

.1 General

.1 Fibrous glass duct liner density 22 kg/cu. m (1.5 lb/cu.ft): one side coated with black neoprene.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50.

.2 Rigid

.1 25 mm (1") thick, to CGSB 51-GP-10M fibrous glass rigid board duct liner. For ductwork located outdoors, increase thickness to 50mm (2”).

.2 Use on all flat surfaces.

.3 Flexible

.1 25 mm (1") thick, to CGSB 51-GP-11M+Amdt-Apr-78, fibrous glass blanket duct liner. For ductwork located outdoors, increase thickness to 50mm (2”).

.2 Use on round or oval surfaces.

2.2 ADHESIVE

.1 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range – 30 degrees C to 93 degrees C (-22 degrees F to 200 degrees F). Meet requirements of NFPA 90A.

2.3 FASTENERS

.1 Weld pins 2.0 mm (0.8") diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm (1-1/4") square.

2.4 JOINT TAPE

.1 Poly-vinyl treated open weave fibre glass membrane 50 mm (2") wide.

2.5 SEALER

.1 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range -68 degrees C to 93 degrees C (-90 degrees F to 200 degrees F). Meet requirements of NFPA 90A-1996.

PART 3 - EXECUTION

3.1 GENERAL

.1 Line inside of ducts where indicated on the Drawings or in Schedules provided on the Drawings.

.2 Duct dimensions shown on the Drawings are clear inside. Increase actual duct dimensions accordingly to maintain clear dimensions indicated on Drawings.

.3 Manufacture duct in lengths to accommodate installation of duct liner.

3.2 DUCT LINER

.1 Install in accordance with manufacturer's recommendations, recommendations of SMACNA, and as follows:

1 Fasten to interior sheet metal surface with 100% coverage of adhesive.

2 In addition to adhesive, install weld pins at one pin per 2 sq. m (20 sq. ft) of liner, but not less than one row per side.

3.3 JOINTS

.1 Seal all joints, exposed edges, weld pin and clip penetrations and all damaged areas of liner with joint tape. Badly damaged areas of lining shall be replaced at discretion of the Consultant.

.4 Seal joint tape in accordance with manufacturer's recommendations, recommendations of SMACNA, and as follows:

1 Bed tape in sealer.

2 Apply two coats of sealer over tape.

.5 Protect leading and trailing edges with sheet metal edging.

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°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

26 00 00.0 0 Index



END OF SECTION

26 01 00.00 Operating and Maintenance Instructions

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 – AS-BUILT DRAWINGS.

1.1.3. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.1.4. Section 26 08 00.00 – COMMISSIONING.

1.1.5. Section 26 08 01.00 – TECHNICAL SERVICES DIVISION STARTUP SERVICE.

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 completion. Provide additional copies if required under the General Requirements. In addition to the three copies of manuals, the contractor to provide a manual in a searchable PDF format on USB stick or sent via electronic transfer. As-Built Drawings to be included on the USB stick or sent via electronic transfer.

3.1.2. The contractor to identify the cost of AS-BUILT 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 – AS-BUILT 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 “Decommission Cafeteria and Great Hall Millwork.”

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 for 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 Material Safety Data Sheet (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. Sub-Contractor 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.

.5 Cyber Security Report Letter and backup schedule as required by Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

3.3. OPERATING INSTRUCTIONS

3.3.1. Instruct the Owner’s representative in all aspects of the operation and maintenance of systems and equipment.

3.3.2. Where commissioning is a requirement of the project, the Contractor shall comply with all requirements of Section 26 08 00.00 – COMMISSIONING, for duration of tests.

3.3.3. Instruct the Owner for a minimum of five (5) working days.

3.3.4. All instruction sessions to be video-taped and copy must be provided to the Engineer's Representative/owner.

3.3.5. Arrange for and pay for the services of engineers and other manufacturers' representatives required for instruction on the systems and the equipment as requested by the Engineer's Representative and/or the Owner.

3.3.6. 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, Engineer's Representative, etc.), system or equipment involved and signature of the Owner'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.

3.3.7. Review information with the Owner's representative to ensure that all information required has been provided.

3.3.8. 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 Owner 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 Owner for any damage 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 workpersonship of any kind.

END OF SECTION

26 05 01.00 General Instructions for Electrical Sections

1. General

1.1. WORK INCLUDED

1.1.1. Conform to the requirements of Division 1, which applies to and forms part of all sections of the work.

1.2. DESCRIPTION OF SECTION

1.2.1. The 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 Electrical Contractor.

1.3. SECTIONS AFFECTED

1.3.1. These instructions apply to and form a part of all electrical sections.

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 Engineer's Representative before submitting the tender. If this is not done the following will be assumed:

.1 Where a discrepancy occurs between the specification and the drawings, the more expensive/onerous alternative will be deemed as included in the contract.

.2 Where a discrepancy occurs in the drawings the more expensive/onerous alternative will be deemed as included in the contract.

.3 Where a discrepancy occurs in the specifications the more expensive/onerous alternative will be deemed as included in the contract.

1.4.3. For any equipment/device where circuit numbers and/or panel designation labels are missing and not indicated on the drawings or specifications, a clarification shall be obtained from the Engineer's Representative before submitting the tender. If this is not done the Contractor shall power the equipment/device from the respective 120 V/208 V or 600 V electrical panel serving the equipment in that area at no additional cost to the Owner.

1.5. REGULATIONS

1.5.1. All work shall be performed in accordance with the latest codes, rules, regulations, by-laws and requirements of all authorities having jurisdiction except where the requirements of the drawings and specifications exceed the codes, rules, regulations, by-laws and requirements of the authorities having jurisdiction.

1.5.2. These specifications are supplementary to the requirements above.

1.5.3. Comply with all guidelines and standards issued by the authorities having jurisdiction.

1.5.4. Drawings and specifications should not conflict with the above regulations but where there are apparent discrepancies the contractor shall notify the Engineer's Representative.

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. If required by code, plans and specifications have been previously submitted to the Authority Having Jurisdiction.

1.6.3. Furnish certificates of Acceptance from the Authority Having Jurisdiction 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, Electrical Contractor will be responsible for the supply and installation of 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.

.1 Where harmonic filter is complete with a capacitor switching system, route a harmonic filter output conductor through the current transformer window within the harmonic filter. Coordinate with Mechanical Contractor and follow harmonic filter manufacturer’s written instructions.

.5 Disconnect switches for all mechanical equipment.

.6 All power wiring (120 V & above) to all mechanical equipment.

.7 Electrical ramp heating cables and controls.

.8 All motorized damper power connections (120 V & 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 120 V control devices.

.6 All 120 V 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 Unistrut supports 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 floor plans, the contractor is to reference the Mechanical Drawings for the location of the respective piece of equipment. No additional costs will be entertained.

1.8.4. Should the Mechanical 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 Mechanical Contractor will incur all extra electrical costs to revise the electrical feeders/wiring, breakers, fuses, starters and equipment to supply power to the revised piece of equipment.

1.8.5. Should the Mechanical Contractor provide alternates to any mechanical equipment selection by deviating from the make and model identified on the Mechanical Schedules and Drawings, the Mechanical Contractor will incur all extra costs to revise the electrical provisions including but not limited to feeders/wiring, breakers, fuses, starters and equipment to supply power to the alternate piece of equipment.

1.8.6. Where power for any flush valves, hands-free faucets, or other powered plumbing fixtures are shown on the Drawings, provide either a hard wired direct connection or a duplex receptacle, as required for the valve/faucet/fixture in question, based on coordination with the Mechanical Contractor.

1.9. PLYWOOD BACKBOARDS, EQUIPMENT MOUNTING, & 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 is to 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 to 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. For clause above, submit documentation as a shop drawing for review by the LEED Representative prior to ordering.

1.9.3. Surface mounted electrical equipment boxes are to be installed on galvanized Unistrut stand-offs. Electrical equipment boxes shall include, but not be limited to electrical panels, LV lighting control, fire alarm, security, communication, electrical sub-metering, etc. Panels are to be grouped on common base wherever practical.

1.9.4. Provide steel re-enforced concrete housekeeping pads under all floor mounted electrical equipment and where noted on the drawings. All housekeeping pads to be a minimum of 100 mm 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 are to 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 LEED Specification sections. Submit documentation as a shop drawing for review by the LEED Representative 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 front end, and Division 1 documents and as described herein. Contractor to coordinate fire stops with General Contractor.

1.12.2. All paints, coatings, sealants and adhesives shall meet the VOC limits in accordance with the LEED Specification sections. Submit documentation as a shop drawing for review by the LEED Representative prior to ordering.

1.12.3. 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 National Building Code of Canada with local amendments or the Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.

.3 Fire stop system rating for sealing junction of rated walls to rated floors and ceilings: to suit the National Building Code of Canada with local amendments or the Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.

1.12.4. Service penetration assemblies: certified by ULC in accordance with CAN/ULC-S115 (latest edition) and listed in ULC Guide No. 40 U19.

1.12.5. 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.

1.12.6. 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 National Building Code of Canada with local amendments or the Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.

1.12.7. 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.

1.12.8. Fire stops and smoke seal all electrical penetrations through rated assemblies as per ULC Standards.

1.12.9. Where sound and vibration control is required, use an elastomeric seal; do not use a cementitious or rigid seal at such locations.

1.12.10. Primers: to manufacturer's recommendation for specific material, substrate, and end use.

1.12.11. Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

1.12.12. Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

1.12.13. Sealants for vertical joints: non-sagging.

1.12.14. Colour: if range available to Engineer’s Representative's choice of standard colours, generally to match background colour where visible in finished spaces.

1.12.15. 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.

1.12.16. Where-holes are core drilled in existing structures, sleeves shall be provided as specified complete with fire stopping as noted above.

1.12.17. 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 Authority having Jurisdiction to confirm acceptability of proposed materials and assemblies.

1.12.18. 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. ACOUSTIC TREATMENT

1.13.1. Electrical Contractor will be responsible for coordinating the electrical installation with the recommendations of the acoustic consultant and their report where one has been included in the contract documents.

1.13.2. Refer to the recommendations of the acoustic report where provided, and provide and install acoustic treatments as necessary. This may include separation of receptacles in stud bays, sealing of junction boxes, application of sound insulating materials etc. Coordinate the installation of these materials with the General Contractor and Drywall/Partition Subtrade.

1.13.3. Do not install back to back receptacles/back boxes within the same stud bay wherever possible. Where it is not possible to stagger receptacles, provide acoustic seal around receptacle/back box to provide acoustic isolation/separation of spaces.

## 1.14. HOISTING

1.14.1. Electrical Contractor will be responsible for the hoisting of all the equipment in the contract. Contractor to coordinate with General Contractor for use of the general hoisting facilities. If hoist facilities are inadequate, then subcontractors must provide their own. Subcontractors must inform general contractors in writing of requirements before tender closing date. Any hoisting required in addition to that provided by the General, will be included in the bid price.

1.14.2. Electrical Contractor to include for the qualified millwrights to move and place all equipment over 1000 lbs. Contractor to provide proof of millwright certification.

1.15. CLEANING AND WASTE REMOVAL

1.15.1. Clean all electrical equipment that has been exposed to construction dust and dirt.

1.15.2. Contractor to clean all electrical equipment, inside and out, prior to turn over to Owner. Equipment is subject to review by Engineer's Representative and/or Owner.

1.15.3. Contractor is responsible to remove their own waste from the site. All re-usable materials shall be recycled.

1.16. SPRINKLERS

1.16.1. All electrical equipment shall be suitable for installation in a sprinklered environment and enclosures are to be CSA Type 1 with drip hood, sprinkler proof enclosure unless otherwise noted.

1.17. TEMPORARY LIGHT AND POWER

1.17.1. Temporary light and power for construction shall be provided, metered, and maintained by the electrical trade, as directed by the General Contractor; but each trade shall provide all extension cords, lamps, etc., required to complete their work.

1.17.2. All temporary light to be fluorescent or LED. Provide adequate lighting to meet all health and safety standards.

1.18. EXAMINATION AND PROTECTION OF SITE

1.18.1. Before submitting Bid, each trade shall examine the site to determine the conditions which may affect the proposed work. No claims for extra payment will be considered because of failure to fulfil this condition.

1.18.2. Contractor to document any existing conditions on site and submit a pre-condition survey including pictures. Contractor will be responsible to 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.

1.18.3. Contractor is to protect trees and plants on site and on adjacent properties. Plants to be protect with burlap. Trees and roots within construction area to be protected by the erection of temporary 2 m high plywood hoarding at the drip line of the tree. Contractor to avoid unnecessary traffic, dumping and storage of materials at or near trees or plants.

1.18.4. When requested by the Owner and/or Engineer's Representative, the Contractor is to provide digital pictures of the site, including but not limited to progress of work and installed equipment, via e-mail to the Owner and/or Engineer's Representative.

1.19. DRAWINGS AND INSTALLATION

1.19.1. 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.

1.19.2. 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 Engineer's Representative to make reasonable changes required to accommodate conditions arising during the progress of the work, at no extra cost to the Owner.

1.19.3. 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.

1.19.4. The actual location of switches, outlets and luminaires, etc. shall be reviewed by the Engineer's Representative before installation.

1.19.5. 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.

1.19.6. 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 extra cost to the Owner.

1.19.7. Leave areas clear where space is indicated as reserved for future equipment, and equipment for other trades.

1.19.8. Adequate space and provisions shall be left for removal of components and servicing of equipment, with minimum inconvenience to the operation of systems.

1.19.9. Where equipment is shown to be 'roughed-in only' obtain accurate information from the Engineer's Representative before proceeding with the work.

1.19.10. Contractor is to review Architect's specifications, drawings and details to confirm locations of devices and equipment.

1.19.11. This Contractor is responsible to mark-out his work, fully coordinated with all other trades, in sufficient time for review by Architectural Consultant prior to rough-in. Prepare dimensioned layouts of each room prior to rough-in for review by Architectural Consultant. Do not proceed with any work until the Architectural Consultant has reviewed the layout drawings.

1.19.12. The Contractor will reimburse the Engineer's Representative 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.

1.20. INSTALLATION, INTERFERENCE AND SETTING DRAWINGS

1.20.1. The Contractor is to complete installation, interference and setting drawings, dimensioned and to scale for all systems. They shall be made available for review by the Engineer's Representative, 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.

1.20.2. Slab layout drawings are to be submitted for review by the Structural Engineer's Representative. These slab layout drawings are to be included in the as-built drawings. Refer to Section 26 05 03.00 – AS-BUILT DRAWINGS.

1.20.3. 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.

1.20.4. 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 Structural Engineer and Architect. 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 Division.

1.21. SUPPLEMENTARY BID FORM AND SUBMISSIONS OF BID

1.21.1. Submit with tender, if included in the documents, a complete Electrical Supplementary Bid Form. Tenders not completed in full may, at the discretion of the Owner be rejected.

1.21.2. Several alternative, separate and itemized prices may have been requested. These shall be completed on the Electrical Supplementary Bid Form. Refer to the specific sections of the specifications and to the drawings for details.

1.22. Approved Manufacturers

1.22.1. Where only one name appears in the specification, the bid shall include for the specified equipment.

1.22.2. Where two or more names are shown in the specifications as alternates or equal to, this division can select which manufacturer is to be carried.

1.22.3. The Contractor is to list substitute equipment as a price deduction to the Bid Price on the Electrical Supplementary Bid Form. Space has been provided to show manufacturers not specifically mentioned. Acceptance of substitute equipment shall be at the discretion of the Owner and/or Engineer’s Representative. Any substitutes not listed on the Electrical Supplementary Bid Form will not be entertained.

.1 The proposed substitution shall show product name and complete description and also what difference, if any, will be made in the amount of the Bid Price for each substitution, should it be accepted.

.2 Materials and products specified by the name of the manufacturer, the brand or trade name, or catalogue reference, shall be the basis of the Bid Price.

.3 Any alternate and/or substitute equipment listed shall be equal in performance and quality to that specified. If space, power, structural or any other requirements are different from the equipment specified, the cost of any changes shall be included for in the price shown on the Electrical Supplementary Bid Form.

.4 The Owner reserves the right to accept or reject any substitution without question.

.5 The "Base and Alternate Equipment" is for North American manufactured products. Where a listed manufacturer can offer either North American or non-North American source for the equipment, the country of origin shall be shown under "Substitute Equipment" and the cost savings shown under "Deduct from Tender Price".

1.23. PRODUCTS AND MATERIALS

1.23.1. Make and quality of materials used in the construction of this project shall be subject to the approval of the Engineer’s Representative.

1.23.2. All equipment and material are to 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 Electrical Inspection Authorities.

1.23.3. Factory assemble control panels and component assemblies.

1.23.4. 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.

1.23.5. 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 extra cost.

1.23.6. Within 30days of the award of contract, the Contractor is to submit a complete list of the manufacturers for all equipment being supplied on the project.

1.23.7. Availability

.1 In submitting Bid, Contractor warrants that all materials are available in suitable time to meet Contract dates.

.2 Subject to sentence .3 below, where the Contractor advises that the Contractor cannot supply materials in suitable time to meet Contract dates, and should it subsequently appear that Work may be delayed for such reason, the Engineer's Representative reserves the right to substitute more readily available products of similar character, even if more costly to the Contractor, at no increase in Contract Price.

.3 Where the Contractor can show that the Contractor promptly ordered the originally specified materials the Owner 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 Owner to pay the cost differential in sentence .2 above.

1.24. CO-OPERATION WITH CONSULTANTS

1.24.1. 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 such as progress billings breakdowns, shop drawing requirements, change order pricing breakdowns, the commissioning process, installation drawings, the specifications, as-built drawings and O+M manuals, along with a number of other items. This job report is intended to reiterate and elaborate on key items of the Contract Documents and is not intended to impose new requirements.

1.24.2. 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 course of 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.

1.24.3. For electrical systems occupancy, provide a PDF copy of the following documents to the Engineer's office for review:

.1 Electrical inspection authority inspection certificate/report with no deficiencies.

.2 Fire alarm verification report with no deficiencies.

.3 CAN/ULC-S561 "Standard for Installation and Services for Fire Signal Receiving Centres and Systems" certificate.

.4 Maglock test and verification report with no deficiencies.

.5 CAN/ULC-S1001 "Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems" reports for electrical systems with no deficiencies.

.6 Letter confirming that all emergency lighting and exit signs are installed and illuminated.

.7 Letter confirming that all unit equipment for emergency lighting (batteries, heads, exit signs) are installed and powered and have been tested to demonstrate that they last for the run time indicated in the Specifications or on the Drawings.

.8 Emergency generator testing and commissioning reports with no deficiencies.

.9 Emergency generator TSSA inspection report with no deficiencies.

.10 Fire pump testing and commissioning reports with no deficiencies.

.11 Emergency power (inverter) testing report with no deficiencies.

.12 Seismic Engineer's letter for seismic restraint system (if applicable).

.13 Letter confirming that all openings in walls and floors for electrical services have been fire stopped.

.14 Cyber Security Report Letter and backup schedule as required by Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

.15 Additional items as indicated by the Engineer's Representative.

.16 Additional items as indicated on the Occupancy of Unfinished Buildings Checklist issued by Engineer's Representative.

1.25. CO-OPERATION WITH OTHER DIVISIONS

1.25.1. Particular attention must be paid to the proximity of electrical conduit and cable to mechanical piping and equipment.

1.25.2. Electrical conduits shall not touch or be supported on pipe or duct walls.

1.25.3. 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 extra cost to the Owner.

1.25.4. The supply of all items is to have built-in to the delivery schedule, ample time for rapid progress of work. Proceed with work determined by the construction schedule.

1.25.5. The Electrical Contractor shall coordinate 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 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 Electrical Contractor.

1.26. TEMPORARY USE OF EQUIPMENT

1.26.1. Where the electrical systems are operated during construction, the Electrical Contractor shall maintain the system and equipment in proper operating condition.

1.26.2. Before any area of the building is turned over to the Owner for acceptance and for beginning of the guarantee/warranty period, the systems and equipment shall be returned to the initial new condition.

1.26.3. Permanent electrical equipment is only to be used upon permission of Owner and Engineer's Representative and is only to be used on a limited basis. All equipment must be cleaned prior to turnover.

1.27. TESTING

1.27.1. General

.1 Refer to the testing requirements outlined in each individual specification section and provide all required staffing, materials, tools and expertise to perform the required testing. Where specification Section 26 08 01.00 - TECHNICAL SERVICES DIVISION STARTUP SERVICE has been included, ensure all testing is performed accordingly by the Technical Services Division Startup Service trade.

.2 This specification is intended to capture the requirements for factory testing, factory witness testing, site startups, site testing and training of electrical equipment. This specification represents a minimum requirement and does not absolve the equipment manufacturers from performing any tests required by the standards referenced in the individual specification sections.

.3 The testing process for the Electrical Systems shall include:

.1 Verification that the installation meets the requirements of the contract documents.

.2 Verification that the system's performance meets the design intent.

.3 Building operator training.

.4 As-Built documentation, operating and maintenance manuals, and systems operating manuals.

.4 The Contractor, Engineer's Representative, Technical Services Division Startup Service (where called for in the Specification) and Commissioning Agent (where identified as part of the project) shall provide the services to complete the process. See further explanation below defining the areas of responsibility.

.5 Provide labour, equipment and material to conduct the testing process as outlined in this Section.

1.27.2. Factory testing

.1 All equipment is to have factory testing performed by the equipment manufacturer. These tests are to include the manufacturers standard factory testing, and any required testing to conform to the standards, and any additional testing referenced in the individual specification sections.

.2 The manufacturer is to perform the required testing and submit test reports recording the results of all tests to the Electrical Contractor for review and if found acceptable submit to Engineer's Representative for Shop Drawing review and the final copy included in the O&M Manuals. Test reports are to be submitted and reviewed by the Electrical Contractor and Engineer's Representative prior to shipment to site.

.3 Any deficiencies noted in the factory testing are to be corrected prior to shipment of electrical equipment unless otherwise agreed to by the Electrical Contractor.

1.27.3. Factory Witness Testing

.1 For all factory witness testing, the manufacturer is to act as the test leader and is responsible for all required organization, coordination, performance of testing and documentation of test results. The manufacturer is to ensure the tests being performed are in alignment with the requirements of the Specification in advance of the testing and provide hard copies of the latest Shop Drawings and test scripts for each attendee of the witness test. Any deviations to the tests being requested in the Specifications and Drawings must be communicated to the Electrical Contractor and Engineer's Representative in advance and must be accompanied with a rationale and/or an alternate test method that demonstrates that the intent of the specified test would be met.

.2 Each factory witness test is to include at a minimum:

.1 Introductions.

.2 A walkthrough of the latest Shop Drawing and review of latest Shop Drawing commentary with discussion on any remaining open items.

.3 A walkthrough of the test script.

.4 A walkthrough of the Design Specifications and Drawings noting/reiterating any required deviations from the design documents in terms of testing requirements.

.5 Performance of tests

.6 At the conclusion of all factory witness tests, the manufacturer is to produce signed factory test results recording all noted results and documenting any remaining deficiencies. Report to include record of the testing instruments used along with calibration dates (where required) and serial numbers.

.3 Factory witness testing shall be attended by the persons as listed below, attendance at the witness testing is at the discretion of each representative and is to be confirmed by all parties prior to witness testing.

.1 One (1) Electrical Contractor Representative

.2 One (1) Engineer Representative

.3 One (1) Commissioning Agent Representative

.4 One (1) Technical Services Division Startup Service Representative

.4 Manufacturers to include for the complete cost of the attendees listed above to attend the factory witness testing for the equipment. Cost to include but not limited to all travel, food and lodging costs. Manufacturer to note, attendees may be coming from different locations within Canada.

.5 Manufacturer to provide factory witness test scripts to the Contractor as a formal Shop Drawing in advance of the factory witness test for review by the Contractor, Engineer and Commissioning Agent through the formal Shop Drawing review process. Factory witness test shall not be scheduled without a reviewed test script.

.6 Manufacturer to notify the attendees minimum two (2) weeks prior to the date the tests are to be performed. Where travel out of province is required, provide minimum four (4) weeks notice.

.7 Manufacturer to perform their own internal quality assurance and control check prior to any factory witness test such that the manufacturer is prepared to perform the complete demonstration of the equipment.

.8 Any deficiencies noted in the factory testing is to be corrected prior to shipment of the electrical equipment.

1.27.4. Site Startup

.1 Manufacturer to include for the costs of technician(s) to perform initial system startup on site as required by the Specifications and Electrical Contractor. Extent of technician(s) involvement to be coordinated with the needs of the Specifications and the Electrical Contractor.

1.27.5. Site tests

.1 Manufacturer to include for the costs of technician(s) to perform site tests as required by the Specifications and Electrical Contractor. Refer to tests identified in the individual Specification sections and include all personnel and equipment to perform testing.

1.27.6. Materials

.1 The Contractor and Manufacturer shall provide all instrumentation and equipment necessary to conduct the tests as specified in the specifications. The Contractor shall ensure the instrumentation to be used are properly and adequately calibrated and if required by the Engineer’s Representative or Commissioning Agent to provide the dates the instrumentation was last calibrated.

1.28. TRAINING

1.28.1. The Manufacturer is to include for qualified technician(s) with project specific knowledge to perform in depth training for facility management team members.

1.28.2. Training may include up to ten (10) attendees and may be video recorded by others.

1.28.3. Training program to include:

.1 One site ‘in class’ introduction session covering the basics of system operation.

.1 Manufacturer to submit a course outline before training commences.

.2 Manufacturer to provide course training documentation (if required) for attendees.

.2 On site ‘hands on’ session covering the specific equipment design and operation details, including:

.1 All operating procedures including automatic and manual intervention procedures.

.2 All regular maintenance procedures.

.3 Troubleshooting procedures.

.4 Spare parts required.

1.28.4. Timing of training to be coordinated with Electrical Contractor and Owner/Facility Management staff and is to be provided in advance of systems supporting critical loads to allow for full ability to operate the systems. The Electrical Contractor/Manufacturer to notify the Owner/Facility Management team a minimum two (2) weeks prior to the date of training.

1.29. LIFE SAFETY INTEGRATION TESTING

1.29.1. Provide testing of the integration of all life safety and fire protection systems.

1.29.2. The Integrated Testing Coordinator (ITC) will complete an Integration Testing Plan (ITP). Carry out the testing as described by the ITC in the ITP, and in accordance with CAN/ULC-S1001 as it relates to any electrical systems.

1.29.3. The ITC and development of the ITP are not the responsibility of this Contractor.

1.29.4. The testing of the integrated systems shall include, but not be limited to the following systems and all associated components:

.1 Fire Alarm System

.2 Fire Signal Receiving Centre

.3 Mass Notification

.4 Elevators

.5 Emergency Generators and/or Inverters

.6 Audio/Visual Systems

.7 Lighting Control Systems

.8 Notification Systems (Public Address)

.9 Sprinkler Systems

.10 Standpipe Systems

.11 Fire Pumps

.12 Water Supplies

.13 Water Supply Control Valves

.14 Heat Tracing for Life Safety Systems

.15 Fixed Fire Suppression Systems

.16 Cooking Equipment Fire Suppression Systems

.17 Automatic Door Operators for Stair Relief

.18 Hold-Open Devices

.19 Electromagnetic Locks

.20 Smoke Control Systems and Associated Dampers

.21 Venting to Aid Firefighting

.22 Smoke Alarms

.23 Hazardous Protection Monitoring

.24 Gas / CO Detection Systems

.25 Prevention of Smoke Recirculation (AHUs)

1.29.5. Coordinate with all other trades to carry out the appropriate testing.

1.29.6. Be responsible for carrying out and coordinating the testing work associated with the ITP. All work shall be coordinated with the ITC and shall include but not be limited to:

.1 Perform functional testing of the integration of all life safety and fire protection systems as a whole to ensure the proper operation and interconnection between the systems.

.2 Testing of the integrated life safety systems must be done as a complete installed assembly; individual component testing or partially installed assembly testing is not acceptable.

.3 Follow the testing methodology for verifying and documentation of operation as outlined in the ITP and in accordance with CAN/ULC-S1001 “Integrated Systems Testing of Fire Protection and Life Safety Systems.”

.4 Provide fire alarm verification report along with all other documentation requested by the ITC as it relates to the electrical systems in conformance with CAN/ULC-S1001 “Integrated Systems Testing of Fire Protection and Life Safety Systems.”

1.30. STATEMENT OF PRICES

1.30.1. To form a basis for progress payments the successful bidder shall submit a sample progress draw for the various portions of the work. The format of the sample progress draw shall be as shown in the example progress draw below. The sample progress draw shall include a breakdown which illustrates all categories shown on the example progress draw which are relevant to the project. The categories shall be broken down to clearly illustrate the value of the material being supplied as the first subcategory and the value of the labour being supplied as the second subcategory, as shown on the example progress draw. The electrical Engineer’s Representative reserves the right to request that additional categories be added to the progress draw if the Engineer’s Representative feels that doing so will aid in assessing the contractor’s progress on site, thereby expediting contractor payment. Progress draws not including the categories shown on the example progress draw where relevant to the project and / or not providing separate labour value and separate material value subcategories will be rejected.

1.30.2. The total price of all portions of the work shall equal the total price of the work covered under the electrical division. Cost for as-built drawings and manuals to be carried as a separate line item.

1.30.3. Contractor to list and track all fixed per unit cost luminaires as part of Light Fixtures - Materials on the progress draw.

1.30.4. Contractor to list and track each of the approved changes on separate lines on the progress draw.

1.30.5. Costs of temporary facilities and utilities shall be amortized over the duration of the Work. Claims for ‘mobilization’, ‘bidding costs’, or similar lump sums at or before start of work are not acceptable.

# EXAMPLE PROGRESS DRAW

**Electrical Contractor Name**
**Billing Application Electrical Division**
**Project Name**

**Application Number – xx** **Date – xxxx to xxxx**

| Description | Contract Value | % | Billed To Date | % | Prev. Billed | % | This Billing | Balance to Complete |
|---|---|---|---|---|---|---|---|---|
| Permits / Mobilization | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Demolition & Removals | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Duct Banks – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Duct Banks – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Feeder Conduit – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Feeder Conduit – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Feeder Wire – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Feeder Wire – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Power & Ltg. Branch Conduit – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Power & Ltg. Branch Conduit – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Power & Lighting Branch Wire – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Power & Lighting Branch Wire – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire Alarm Conduit – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire Alarm Conduit – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire Alarm Cable – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire Alarm Cable – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Comms / Security / AV Conduit – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Comms / Security / AV Conduit – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Comms / Security / AV Cable – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Comms / Security / AV Cable – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Distribution Equipment – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Distribution Equipment – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Generator / Inverter – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Generator / Inverter – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Light Fixtures – Material† | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Light Fixtures – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Lighting Controls – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Lighting Controls – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire Alarm Equipment – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Fire Alarm Equipment – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Wiring Devices – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Wiring Devices – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Hand Dryers – Material | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Hand Dryers – Labour | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Commissioning / Training | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Demobilization / Clean-up | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Manuals / As-Built Drawings | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Subtotal | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| **Additions to Contract** | | | | | | | | |
| CO # / PC # / CCN # | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xx,xxx.xx |
| Cash Allowance # | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xx,xxx.xx |
| | --- | | --- | | --- | | --- | --- |
| Subtotal | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xxx | xx,xxx.xx | xx,xxx.xx |
| | --- | | --- | | --- | | --- | --- |
| | --- | | --- | | --- | | --- | --- |
| Total Contract | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx | xxx,xxx.xx | xxx,xxx.xx |
| Less Holdback | | | xxx,xxx.xx | | xxx,xxx.xx | | xxx,xxx.xx | |
| | | | --- | | --- | | --- | |
| Total | | | xxx,xxx.xx | | xxx,xxx.xx | | xxx,xxx.xx | |

† Inclusive of fixed per unit cost luminaires. Refer to luminaire schedule and/or electrical supplementary bid form for luminaire fixed unit costs.

## 1.31. METRIC CONVERSIONS

1.31.1. 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.

## 1.32. INTERRUPTION OF SERVICES

1.32.1. Any interruption of the electrical services to any part of the building shall come at a time agreeable to the Engineer's Representative. Make all necessary arrangements with those concerned and include for any overtime required to ensure that the interruption is held to a minimum.

1.32.2. Testing and operation of major equipment shall be approved by the Engineer's Representative to avoid excessive electrical utility charges. Such testing to be generally carried out after normal working hours or on weekends.

1.32.3. All such overtime work shall be carried out without additional cost to the Owners.

1.32.4. Modifications to existing electrical equipment, which will require shutdown, must be coordinated with the Owner and will only be permitted on weekdays from 10:00 pm to 6:00 am and on weekends from Friday at 7:00 pm to Sunday 6:00 pm. Exact weekends to be co-ordinated with the Owner. Consecutive weekends of shutdowns will not be allowed. Contractor to pay for all utility costs associated with shutdowns. Any work not associated with live equipment can be done during normal working hours. Work considered disruptive to the normal operation of the building will be done after normal business hours. Exact times to be co-ordinated with Owner.

1.32.5. Contractor to provide a minimum of 5 days written notice of a requirement for a shutdown. Contractor to include for separate meetings with the Owner and Engineer's Representative to discuss the shutdown in detail and to coordinate all the work being performed.

1.32.6. The Contractor is responsible for co-ordination and isolating of 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 owner will not perform any isolations for the contractor but will be present during the work. The contractor is to use qualified personnel for these shutdowns ensuring compliance with all applicable safety requirements.

1.32.7. The Contractor is responsible for any damages caused to existing systems when making connections.

1.32.8. The Contractor is to 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. This Contractor is to include for as many multiple teams of electricians as is feasible to keep the shutdown work to a minimum.

1.33. PRE-PURCHASED EQUIPMENT

1.33.1. The Electrical Trade shall assume complete responsibility for the Owner's pre-purchased equipment and its associated equipment as if it had been purchased by the Contractor, with the single exception of payment.

1.33.2. The Electrical Trade shall provide a warranty for all pre-purchased equipment during the warranty period and shall include for all labour, material and shipping charges not covered in the manufacturer's warranty to completely repair or replace any defective pre-purchased equipment at no cost to the Owner during the warranty period.

1.33.3. The Electrical Trade shall take complete responsibility for the co-ordination of delivery of the separate items of equipment and their proper placement as required by jobsite conditions.

1.33.4. The Electrical Trade shall provide all materials and labour required to incorporate pre-purchased equipment into a working system whether or not shown on the Drawings or specified herein.

1.33.5. The following list of equipment is pre-purchased:

.1

1.34. PRE-TENDERED EQUIPMENT

1.34.1. The Electrical Trade shall assume complete responsibility for the Owner's pre-tendered equipment and its associated equipment as if it had been purchased by the Contractor, including payment.

1.34.2. The Electrical Trade shall provide a warranty for all pre-tendered equipment during the warranty period and shall include for all labour, material and shipping charges not covered in the manufacturer's warranty to completely repair or replace any defective pre-tendered equipment at no cost to the Owner during the warranty period.

1.34.3. The Electrical Trade shall take complete responsibility for the co-ordination of delivery of the separate items of equipment and their proper placement as required by jobsite conditions.

1.34.4. The Electrical Trade shall provide all materials and labour required to incorporate pre-tendered equipment into a working system whether or not shown on the Drawings or specified herein.

1.34.5. The following list of equipment is pre-tendered: Insert the list of Owner Pre-tendered equipment or delete this if none are being included in the project

.1

1.35. VALUATION OF CHANGES

1.35.1. Further to contract requirements, the method to be used in determining the value of a change to the Work, by either Change Order or Change Directive, shall be:

.1 Estimate and acceptance in a lump sum, unless the Engineer's Representative otherwise determines that the method shall be unit prices set out in the Contract.

1.35.2. Contractor shall provide the Engineer's Representative with a detailed cost analysis of the contemplated change indicating:

.1 Quantity of each material.

.2 Unit cost of each material.

.3 Time involved.

.4 Sub-trade quotations including a complete analysis of costs.

.5 Mark-ups, if applicable.

.6 Value of GST or HST, as applicable.

.7 Proposed change in Contract Time.

1.35.3. The detailed cost breakdown is to list material and labour separately for each item on the proposed change. The breakdown for contemplated change is to follow the format of the attached document.

1.35.4. The following shall not be included in the cost of the work but are covered by the hourly labour rate:

.1 The Contractor's payroll, administrative, head office and site office expenses, including stationary, postage and other office supplies.

.2 The costs of the Contractor's Project Manager, clerical and administrative personnel, and executive personnel.

.3 Use of temporary offices, sheds, small/hand tools, storage, and site office consumables, etc., including but not limited to the cost of telephone, light, power, water and heat used therein.

.4 Transportation and overnight room expenses for out of town labour, if local labour is unavailable.

.5 Insurance premiums, all government payroll burdens, variable labour factors and union or association funds.

.6 Licenses and permits, except when these are special for a particular item of work.

.7 Printing charges for Proposed Changes, Change Orders and Drawings for Contractor's and Subcontractors' use in the work. Engineer's Representative will provide a PDF electronic copy of change notice documentation.

.8 The cost of preparing As-Built, layout and working drawings and shop drawings. This includes any and all AutoCAD/BIM costs related to interference drawings or other associated drawings that may be required as part of the changes.

.9 The cost of clean-up and disposal of waste material.

.10 Parking, travel, coffee break/rest periods, warranties, safety training, WHMIS and health and safety committee, and non-productive time.

.11 Rentals, additional bonding, project financing.

1.35.5. The Contractor shall not be entitled to any additional compensation arising out of changes to the Work other than the amounts determined and agreed to under CCDC 2-2020 GC 6.2.

1.35.6. The Contractor shall inform the Surety Company or Companies who have issued any bonds for this Contract, and any Insurers who have insured any part of the work or operations or who have an interest in this Contract, of all changes in the Contract. Pay all costs of any changes in bonds or insurances required to maintain bonds or insurances in conformance with the requirements of the Contract Documents. Provide Owner immediately with any revised bonds or insurances.

1.35.7. Special equipment rental rates will be charged at cost. The Contractor shall provide an official quotation of the equipment rental with the Proposed Change quotation as backup, otherwise special equipment rentals will not be accepted by the Owner/Consultant.

1.35.8. The maximum percentage fee for mark-ups shall be as stated in the Division 0/1 specifications or the Contract Supplementary Conditions.

1.35.9. All changes, change notices, revisions to contract, Supplemental Instructions, change directives or any additional costs or deletes to the stipulated lump sum contract price are subject to review and scrutiny by a qualified third party or individual.

1.35.10. The material costs used shall be a discount to nationally available pricing guides (i.e. Trade Service, Allpricer, etc.) to reflect a value with a fair and reasonable markup to the actual cost of the materials purchased from distributors. The Owner and/or Engineer's Representative reserve the right to negotiate material pricing to a value that is fair and reasonable to the Owner.

1.35.11. Labour Rate

.1 During the duration of the electrical contract, extra work hourly labour units are to be based on the latest edition of the National Electrical Contractors Association (NECA) labour units column 1(one). No additional factors will be accepted.

.2 The hourly labour rate for all changes will be based on a Journeyman Electrician rate as listed on the Bid Form and/or Electrical Supplementary Bid Form. The Owner and/or Engineer's Representative reserve the right to renegotiate the labour rate. The hourly labour rate will be inclusive of overhead, markup and profit. The labour rate will be inclusive of all labour burden charges as stated in this 'Valuation of Changes' section above.

.3 The following labour burdens are not part of the hourly labour cost, but are covered under the NECA labour unit rates: safety measures and regulations; drawing and specification study; layout, measuring and marking the installation location; material unloading, jobsite storage and delivery to the installation area; inspection, uncrating and shipping support removal; tool acquisition and return to storage; clean-up of excess material; and testing circuits for continuity.

.4 At the request of the Owner or the Engineer's Representative, the Contractor is to submit a detailed labour cost breakdown showing a breakdown of all adders to the base wage rate to show how the Contractor has come to the proposed hourly rate. The Owner and the Engineer's Representative reserve the right to negotiate the hourly labour rate with the Contractor.

1.35.12. When pricing additional work for Proposed Changes, the Electrical Contractor shall only price new materials that are required for the Proposed Change. Where existing materials and/or infrastructure (i.e. homerun conduits back to electrical panels) can be re-used for the Proposed Change, the Electrical Contractor shall utilize these items in the valuation of the Change at no extra cost.

1.35.13. Where a Proposed Change includes both credits and extras, overhead and permitted mark-ups apply to the net extra or credits, if any, of the entire change.

1.35.14. When pricing Proposed Changes containing both additions and credits, and where no work and/or materials have been installed on site, the Electrical Contractor shall only price the net new materials and net new labour that are required for the Proposed Change. Per unit labour and material costs shall be equal for credits and additions.

# PROPOSED CHANGE ORDER

Company Name:
Address:
City, Prov.:
Postal Code:

Telephone:
Fax:
E-Mail address:

Client Address:

CCN #
Date:
Project Name:
Project Number:
Page Number:
Change Order #:

**Work Description**

We reserve the right to correct this quote for errors and omissions.
This quote covers direct costs only.
This price is good for acceptance within 30 days from the date of receipt.

**Itemized Breakdown**

| Description | Qty | Net Price U | Total Mat($) | Labor U | Total Hours |
|---|---|---|---|---|---|
| ¾’ EMT | | xxx.xx C | | 5.00 C | |
| ¾’ EMT STL SS CONN | | xx.xx C | | 10.00C | |
| ¾’ EMT STL SS CPLG | | xx.xx C | | 5.00 C | |
| ¾’ EMT STRAO 1-H | | xx.xx C | | 4.00 C | |
| #10 x 1” SELF TAPPING SCREW | | x.xx C | | 5.50 C | |
| TOTALS | | | | | |

**Description**

**Material**

General Materials _____
Permitted Mark-up (@ xx.xx %) _____
**Material Total** _____

**Labour**
Journeyman (xx Hrs. @ $xx.00) _____
Foreman @ 10% (xx Hrs. @ $xx.00) _____
**Labour Total** _____

**Material and Labour Total** _____

**Final Amount** _____

1.36. DEMOLITION

1.36.1. 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.

1.36.2. 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 by this division.

1.36.3. 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 Owner.

1.36.4. Make safe and disconnect all power and systems, as and when, and to the extent required to facilitate the demolition.

1.36.5. If applicable, review the mechanical, architectural, and other related discipline drawings, and include for removing and making safe all power connections to demolished equipment and devices, back to the source panel, except where indicated otherwise on the drawings.

1.36.6. 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.

1.36.7. 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.

1.36.8. Remove and replace any electrical equipment on walls or ceilings that will be demolished and rebuilt.

1.36.9. 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 Owner at a place designated by the Owner. Cut back and cap unused raceway and outlets and remove unused wiring back to panelboard in an approved manner.

1.36.10. Ensure that all existing equipment which is to 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 local authorities having jurisdiction. All existing electrical equipment which is no longer required shall be removed and disposed of off-site.

1.36.11. Carry out the work with a minimum of noise, dust and disturbance.

1.36.12. Provide tools and clean up equipment. Obtain the Owner's permission for the use of electrical, plumbing or drainage outlets.

1.36.13. Where a device is shown to be relocated on the drawings, contractor to 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.

1.36.14. Electrical Contractor is responsible for the patching and re-painting the entire wall where a device and/or box has been added, removed or relocated.

1.37. CYBER SECURITY

1.37.1. Coordinate with Owner’s Information Technology representatives, obtain a copy of Owner’s cyber security policy and provide all applicable cyber security configurations.

1.37.2. Definitions

.1 Cyber Assets: Systems (including hardware, software, and data) and communication networks (including hardware, software, and data).

.2 Critical Cyber Assets: Cyber assets that perform critical system functions. The loss or compromise of these cyber assets would adversely affect the operational reliability of the system.

.3 Cyber Attack: The use of electronic means to interrupt, manipulate, destroy, or gain unauthorized access to a computer system, network, or device.

.4 Cybercrime: Any crime where cyber – the internet and information technologies, such as software, firmware, computers, tablets, personal digital assistants or mobile devices – has a substantial role in the commission of a criminal offence.

.5 Cyber Hygiene: Practices and steps that users of computers and other devices take to maintain system health and improve online security. These practices are often part of a routine to ensure the safety of identity and other details that could be stolen or corrupted.

.6 Cyber Incident: Any unauthorized attempt, whether successful or not, to gain access to, modify, destroy, delete, or render unavailable any computer network or system resource.

.7 Cyber Security: Technologies, processes, and practices designed to protect networks, devices, programs, and data from attack, damage, or unauthorized access.

.8 Cyber Threat or Cyber Security Threat: Malicious act that seeks to damage data, steal data, or disrupt digital life in general. Cyber threats include computer viruses, data breaches, Denial of Service (DDoS / DoS) attacks and other attack vectors.

.9 Cyber Threat Actors: Broad term for any states, groups, or individuals who, with malicious intent, aim to take advantage of vulnerabilities, low cyber Security awareness, and technological developments to gain unauthorized access to information systems in order to access or otherwise affect victims' data, devices, systems and networks.

.10 IP Multicast: Technique for one-to-many and many-to-many real-time communication over an IP Infrastructure network.

.11 Endpoint: Remote computing device that communicates back and forth with a network to which it is connected. Such as a server, desktop, or laptop.

.12 Network Certificates: Also known as a Digital Certificates, which are an electronic "password" that allows a person or organization to exchange data securely over the internet using the public key infrastructure (PKI). Digital Certificates are also known as a public key certificate or identity certificate. There are 3 Main types of certificates:

.1 Secure Socket Layer Certificate (SSL) Digi-SSL

.2 Software Signing (Code Signing Certificate) Digi-Code

.3 Client Certificate (Digital ID) Digi-ID

.13 Social Engineering: Exploitation methods that target human vulnerabilities, such as carelessness and trust.

.14 Technical Vulnerabilities: Weaknesses or flaws in the design, implementation, operation, or management of an information technology system, device, or service.

1.37.3. Cyber Security Measures

.1 Implement at minimum the following multi-layered Cyber Security measures to limit and / or reduce the Owner's potential risk from a cyber threat event; such as a Cyber Security data breach or Cyber Security attack.

.2 Password Management

.1 Employ password management best practices such as:

.1 Do not use default passwords.

.2 Use strong and unique passwords for all applications. Use a minimum of 8 characters where there is no password policy inherent in the software; use a mixture of uppercase and lowercase letters, numbers, and include at least one special character (! @ # ? ]).

.3 Reset passwords at regular intervals.

.4 Configure two-factor authentication for all accounts where possible in the system software.

.5 Do not use System Admin logins for simple tasks; create separate User accounts with rights levels appropriate for the job function. Create and define user accounts as appropriate such as Role based, Individual logins or assigned roles.

.6 Use different passwords for every account.

.7 Enforce secure password policies within the business environment.

.8 Have interface lock after a predefined # of failed login attempts for a pre determined time interval.

.3 Port and Interface Management

.1 Employ Port Management techniques such as:

.1 Restrict access on network switch ports to assigned devices addresses.

.2 Lock down all open, unused and unsecure ports on the networking devices such as switches, routers, and firewalls.

.3 Shut off all unused communication services and hardware interfaces.

.4 Advise Owner on use of 3rd party port security monitoring.

.4 Physical and Virtual Networks

.1 Provide a dedicated VLAN for network connected systems where a dedicated LAN has not been provided.

.5 Encryption

.1 Use minimum TLS 1.2 for all network attached equipment and use TLS 1.3 where available.

.6 Network Certificates

.1 Ensure Network Certificates are up to date and not expired for all equipment and systems.

.7 Firmware & Software Update Management

.1 Use the latest stable Firmware / Software version on all devices / equipment as well as implement a Firmware / Software Update management process and procedure.

.8 Manufacturer’s System Hardening Guides

.1 Provide the Manufacturer’s System hardening guides for the equipment being installed and implement as many recommendations / features as possible.

.9 External Memory

.1 Restrict the use of external memory. Restrict or eliminate the use of devices such as external USB Thumb drives unless expressly allowed by the Owner’s Information Technology representatives.

.10 Log Off

.1 Enable auto-log off timer for all software, websites and logins. Set auto-log off timer on local Workstation(s) being used to access the equipment with a

reasonable timer in the case that an employee leaves the workstation unattended.

.11 Anti-Virus Software

.1 Enable and configure anti-virus software on PC endpoints in accordance with the Owner's Information Technology requirements, unless it is to be installed and configured by the Owner.

.12 Filtering Techniques

.1 Apply filtering techniques including the types listed below where possible:

.1 Web Filtering: A Web filter adds another layer to anti-phishing defences by blocking the web based component of phishing and malware attacks.

.2 Multicast Message Filtering: Filters the packets sent to multicast groups users are not subscribed to.

.3 Content Filtering: Is the use of a program to screen and / or exclude access to web pages or email deemed objectionable. A content filter will then block access to this content.

.13 Back up Regularly

1. Provide backup schedule in the closeout submittals and configure system for automatic backups wherever possible.
2. Identify files that require manual backup and the backup procedure. This helps to protect against many types of data loss, especially if a Cyber Threat Actor gains access.

1.37.4. IT Devices and Systems

.1 Apply the Cyber security measures listed in the clauses above in part or in full, as possible, to a wide range of Information Technology (IT) Devices including:

.1 Firewalls

.2 Routers

.3 Network switches (Core and Edge Devices)

.4 Servers and databases

.5 Workstation computers

.6 Network connected system devices and controllers

.7 Wireless Access Points and wireless controllers

.8 Mobile phones and tablets

.9 Any IT System or endpoint connected to the network

1.37.5. Operational Technology (OT) Devices and Systems

.1 Apply the Cyber security measures listed in the clauses above, in part or in full, as possible, to a wide range of OT Network devices including:

.1 Industrial Control Systems such as:

.1 (PLC's) Programmable Logic Controllers are an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices.

.2 (SCADA) Supervisory Control and Data Acquisition is a control system architecture comprising of computers, networked data communications and graphical user interfaces (GUI) for high level process supervisory management.

.3 (DCS) Distributed Control System is a computerized control system for a process or plant usually with many control loops, in which autonomous controllers are distributed throughout the system.

.4 (CNC) Computer numerical Control is the automated control of machining tools (Drills, boring tools, lathes) and 3D printers by means of a computer.

.2 Building Management Systems (BMS) and Building Automation Systems (BAS)

.3 HVAC equipment

.4 Lighting controls for both internal and external applications

.5 Energy monitoring and metering equipment

.6 Transportation and parking systems

.7 Scientific equipment

.8 Any other OT System or endpoint that can be connected to the network

1.37.6. Report Cybercrime

.1 Advise the Owner and / or their representatives of any indication of a Cyber Incident of a criminal nature when performing any work on a network connected system.

1.37.7. Cyber Security Report Letter

.1 Provide a Cyber Security Report Letter in the closeout documents to the client stating which Cyber Security measures have been implemented, when implementing any and / or all of the Cyber Security Measures mentioned in this Specification.

2. Products

2.1. NOT USED

3. Execution

3.1. NOT USED

END OF SECTION

26 05 03.00 As-Built Drawings

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.2. RELATED WORK SPECIFIED ELSEWHERE

1.2.1. Refer to As-built Drawings in Section 01 70 00 (01 72 29.00) – CLOSEOUT SUBMITTALS.

1.3. RECORD OF REVISIONS ON SITE

1.3.1. Print and maintain two complete sets of white prints to mark the project progress, changes and deviations.

1.3.2. Maintain an updated copy of plans and schematics in the digital format for which the project is provided (i.e. AutoCAD or Autodesk Revit MEP) and be capable to produce documents in Adobe PDF upon request.

2. Products

2.1. AS-BUILT DRAWINGS

2.1.1. Request in writing from the Engineer's Representative all electrical Choose an item. drawings. Complete release form provided by Engineer's Representative and pay the Engineer's Representative directly the costs identified in this section below prior to receiving the drawings. After the final as-built drawings have been reviewed, send the Engineer's Representative a copy via electronic transfer for their records and send a minimum of one copy on USB key with each set of maintenance manuals. Provide additional copies if required under the General Conditions. Use the latest release of Choose an item. software, and provide electronic files saved in a version acceptable to the end user and engineer.

2.1.2. The contractor is to identify the cost of As-Built Drawings and the Operation and Maintenance Manuals as a separate line item on their progress draw. The following values are to 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 |

2.1.3. 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.

2.1.4. Final as-built prints/plots shall not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.). References to the Architect and Engineer must be deleted from the drawings.

2.1.5. Final as-built drawings to include all revisions made to the drawings during construction, including all approved changes. The as-built drawings are to also include the routing of all feeders except for branch circuits, all junction boxes to be shown, drawing legend to 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.

2.1.6. CADD 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., are not to be used.

.3 Final as-built drawings shall be returned on USB stick.

.4 Each USB stick shall include a file containing Engineer's Representative and Owner, Contract number, file names and Drawing number. Provide a "readme.txt" file in ASCII format. A printed copy of the readme file shall accompany each USB stick.

.5 All drawings shall be in the same units as issued on Bid 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.

2.1.7. Maintain records on site, as the job progresses, and record all changes and deviations from that shown on Contract Drawings. After review and approval of service lines in trenches, take "as-built" measurements, including all depths, prior to commencement of backfilling operations. Show the location of buried electrical ducts and conductors on the drawings and dimensioned from fixed points. Keep drawings up-to-date during construction and in addition to field measurements include Change Orders, Supplemental Instructions and all other changes.

2.1.8. On completion of the building, forward to the Engineer's Representative the digital drawings indicating all such changes and deviations for review by the Engineer's Representative.

2.1.9. If required, the Engineer's Representative will provide a quotation to this Contractor to transfer "As-Built" information from the mark-up documentation to the acceptable software.

.1 Include a cost of $400.00 per sheet for the transfer of marked up "As Built" information to Choose an item. and forwarding of the electrical information by the Engineer's Representative to the Owner

2.1.10. The Electrical Contractor may request from the Engineer's Representative the most current electrical drawings in Choose an item. sent via electronic transfer (at a nominal charge of Choose an item.).

2.1.11. The Choose an item. as-built documents shall meet all the Owner's and Engineer's Representative's requirements.

3. Execution

3.1. NOT USED

END OF SECTION

26 05 04.00 Submittals/Shop Drawings

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 Div. 00 for submittal requirements and as amended below.

2. Products

2.1. SHOP DRAWINGS

2.1.1. Shop Drawings shall be organized by Specification Section. Ensure shop drawing package for a given Specification Section is complete, including all equipment, products, materials, and systems to be used as part of that Specification Section, and submit as a single shop drawing package. Do not submit numerous separate shop drawings for the same 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 Engineer's Representative shall be returned as not reviewed. Provide the following information in the email submission:

.1 S+A 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 the following email address:

.1 ContractAdmin.Toronto@smithandandersen.com

2.1.4. Shop drawings submitted directly to Smith + Andersen personnel (and not copied to the email address provided above) without advanced permission will not be processed nor considered as received.

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 Engineer's Representative 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, and title of section with space for Shop Drawing review stamps for the Contractor and Engineer's Representative.

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 he has checked the drawing for conformance with all requirements of the Drawings and Specifications, that he 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 electrical and mechanical co-ordination is complete before submitting drawings for review.

3.1.2. Scanned PDF versions are not acceptable.

3.1.3. Equipment shall not be released for manufacture until the shop drawing has been reviewed by Engineer's Representative. 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 Engineer's Representative has been obtained.

3.1.4. As part of the electrical Engineer's Representative'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 electrical Engineer's Representative for time expended in these extra reviews.

END OF SECTION

# 26 05 05.00 Mounting Heights

## 1. General

### 1.1. WORK INCLUDED

1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

## 2. Products

### 2.1. NOT USED

## 3. Execution

### 3.1. MOUNTING HEIGHTS

3.1.1. Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

3.1.2. If mounting height of equipment is not specified or indicated, verify with the Consultant before proceeding with installation.

3.1.3. 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: 900 mm.
- .3 Receptacles for maintenance of equipment located on rooftops:
  - .1 Not less than 750 mm above the finished roof, per Electrical Code.
- .4 Panelboards: 2000 mm to top of panel.
- .5 Telephone and interphone outlets: 450 mm.
- .6 Wall mounted telephone and interphone outlets: 1050 mm.
- .7 Fire alarm stations: 1200 mm, measured to the top of the manual pull station.
- .8 Wall Mounted Fire alarm audible devices: 2300 mm and not less than 150 mm from the ceiling, measured to the top of the device.
- .9 Television outlets not mounted behind a wall mounted television: 450 mm.
- .10 Wall mounted speakers: 2100 mm.
- .11 Clocks: 2100 mm.
- .12 Power Door Operator push buttons: 1050 mm.
- .13 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.

.14 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.

.15 Wall mounted occupancy sensors: 1050 mm.

.16 Wall mounted visible signal devices: 2100 mm to centre of lens; or as allowed by CAN/ULC-S524 “Standard for Installation of Fire Alarm Systems” except where facility accessibility standards require otherwise.

.17 Top of remote annunciator and passive graphic panels shall be no more than 1800 mm above finished floor.

.18 Wall mounted emergency telephone (Fireman’s Handset): 1350 to 1500 mm.

END OF SECTION

26 05 21.00 Wires and Cables Under 2000 V

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 08 01.00 – TECHNICAL SERVICES DIVISION STARTUP SERVICE.

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. 124, Mineral-Insulated Cable, latest edition.

1.2.8. CSA C22.2 No. 131, Type TECK 90 Cable, latest edition.

1.2.9. CSA C22.2 No. 174, Cables and Cable Glands for Use in Hazardous Locations, latest edition.

1.2.10. CAN/ULC S139 / UL 2196 (Binational Standard), Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control, and Data 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. Contractor to provide copper conductors on conductors sizes up to and including #8 AWG. Contractor to provide copper conductors for sizes larger than #8 AWG unless identified as aluminium or NUAL on the drawings.

2.1.3. All conductors to have size as indicated, with insulation of chemically cross-linked thermosetting polyethylene material rated RW90 or RWU90 to CSA C22.2 No. 38 rated as follows:

.1 Insulation rated at 1000 V for 600 V systems that are ungrounded or have a neutral grounding resistor to limit ground fault current.

.2 Insulation rated at 600 V for the other 600 V and 347/600 V distribution systems not covered under item #1 above.

.3 Insulation rated at 600 V for all systems rated at 480 V and less.

2.1.4. All aluminium or NUAL conductors to 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 NOALOX, on all aluminum conductor terminations.

2.1.5. RWU90 wiring is to be used for underground installations.

2.2. TECK CABLE

2.2.1. Cables to CSA C22.2 No.131.

2.2.2. Conductors:

.1 Bonding conductor: copper.

.2 Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.

2.2.3. Insulation:

.1 Chemically cross-linked thermosetting polyethylene type RW90, rated 1000 V.

2.2.4. Inner jacket: polyvinyl chloride material.

2.2.5. Armour: interlocking aluminum.

2.2.6. Overall covering: thermoplastic polyvinyl chloride material rated at a minimum of FT-4. Provide FT-6 jacket when TECK cables are run in return air plenum.

2.3. VARIABLE FREQUENCY DRIVE CABLES

2.3.1. Variable frequency drives are also known as variable speed drives.

2.3.2. Cables to CSA C22.2 No. 123 or No. 131, and to CSA C22.2 No. 174.

2.3.3. Conductors:

.1 Three (3) bare copper bonding conductor sized to Table 16 of the electrical code.

.2 Circuit conductors: copper, size as indicated on Drawings.

.3 Profile of VFD Cable cross section shall be entirely symmetrical.

2.3.4. Shield: Flat copper tape shield, or continuously corrugated and welded aluminum sheath, depending on cable construction.

2.3.5. Insulation:

.1 Chemically cross-linked thermosetting polyethylene (XLPE) with high dielectric strength to withstand repetitive high voltage spikes of 3.1 times the nominal system voltage rating due to VFD IGBT output.

.2 Type RW90 or RWU90 CSA rated for 1000 V, and suitable for voltage spikes mentioned in .1 above.

2.3.6. Where compliant with CSA C22.2 No. 123, Armour: continuously corrugated and welded aluminum.

2.3.7. Where compliant with CSA C22.2 No. 131, Inner jacket: polyvinyl chloride material.

2.3.8. Where complaint with CSA C22.2 No. 131, Armour: interlocking aluminum.

2.3.9. Overall covering: thermoplastic polyvinyl chloride (PVC) material rated at a minimum of FT-4.

2.3.10. Cable to be complete with manufacturer's cable termination kits including terminating connectors for proper termination of shield to ground. Termination kits to ensure common mode stray currents are drawn away from the motor to extend motor life-span. Termination kits to include self-terminating connectors that provide 360 degree contact to the shield / sheath.

2.4. MINERAL-INSULATED CABLES

2.4.1. Conductors: solid bare soft-annealed copper, size as indicated.

2.4.2. Insulation: compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable.

2.4.3. Overall covering: annealed seamless copper sheath, Type M1 rated 600 V, 250 C.

2.4.4. Outer jacket: PVC applied over sheath, where installed in damp and wet locations.

2.4.5. Two (2) hour fire rating.

2.4.6. Conform to requirements of CSA C22.2 No. 124; and CAN/ULC S139.

2.4.7. All mineral-insulated cable larger than #6 AWG shall be single conductor. For conductors #6 AWG and smaller, multi-conductor mineral-insulated cable is acceptable.

2.5. FIRE RATED MC CABLE

2.5.1. Conductors: stranded annealed copper, size as indicated.

2.5.2. Insulation: low smoke silicon rubber.

2.5.3. Armour: continuously welded and corrugated copper sheath.

2.5.4. Outer Jacket: Provide black low smoke, zero halogen polyolefin, FT4 rated where installed in damp and wet locations.

2.5.5. Two (2) hour fire rating.

2.5.6. Conform to requirements of CSA C22.2 No. 123; and CAN/ULC S139 with hose stream.

2.6. ARMOURED CABLES

2.6.1. Cables to: CSA C22.2 No. 51.

2.6.2. Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.

2.6.3. Type: AC90 (BX).

2.6.4. Armour: interlocking type fabricated from aluminium strip.

2.6.5. 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.

2.7. ALUMINUM SHEATHED CABLE

2.7.1. Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.

2.7.2. Insulation: type RA90 rated 1000 V.

2.7.3. Sheath: aluminium applied to form continuous corrugated seamless sheath.

2.7.4. Outer jacket of PVC applied over sheath for direct burial or wet locations.

2.8. DIESEL LOCOMOTIVE CABLES (DLO)

2.8.1. Cable: to CSA C22.2 No. 96 Portable Power Cables, rated to 2000 V.

2.8.2. Conductor: stranded tinned annealed copper, size and number as indicated

2.8.3. Separator: paper or polyester tape separates the conductor from the rubber insulation to aid in stripping.

2.8.4. Insulation: premium grade Ethylene Propylene Rubber (EPR), rated 90 deg. C.

2.8.5. Jacket: black, heavy duty chlorinated polyethylene (CPE), sunlight resistant, rated at a minimum of FT-4.

2.9. WIRING TERMINATION

2.9.1. Lugs, terminals, screws used for termination of wiring to be to be dual rated for Copper/Aluminum (Cu/Al).

2.9.2. Lugs, terminals, and 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. Provide separate bonding conductors for each ground fault circuit interrupter circuits. All bonding conductors to be copper and insulated with a green coloured insulation.

3.1.2. Size bonding conductor to applicable tables of the:

.1 Ontario Electrical Safety Code.

3.1.3. All equipment, junction boxes, pull boxes, liquid tight flex, etc. to be bonded to ground through bonding conductors.

3.1.4. Provide separate neutral conductor for each 120 volt circuit for all circuits feeding receptacles and power outlets.

3.1.5. Do not install cables or devices on the surface of, or within 100 mm of the underside of roof decks.

3.1.6. Ensure slack is provided in wiring connections to equipment which contains moving parts.

3.1.7. Provide a variable frequency drive (VFD) cable from each VFD unit to each motor. Wiring to be installed in accordance with the VFD and motor manufacturer instructions.

3.1.8. All cable terminations to be compression type fittings for wire sizes greater than #8 AWG. All compression type fittings to be two-hole long barrel type with lug inspection / viewing window. Where mechanical screw type lugs are allowed by the Engineer’s Representative, they will be suitable for quantity of parallel runs of wire that are to be terminated under.

3.1.9. 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 3 m. Contractor to receive written approval from the Engineer’s Representative to run armoured cable further than 3 m from junction box. Daisy chaining of fixtures is only acceptable in dry wall ceilings. Wiring in conduit is to be brought to a junction box to allow for the transition to armoured cable. Armoured cable is not to be installed directly into electrical panels or run in walls for receptacles.

3.1.10. Branch circuit wiring to be upsized as follows to address voltage drop when:

.1 The entire length of the circuit wiring exceeds 25 m – branch wiring to be a minimum of No. 10 AWG.

.2 The entire length of the circuit wiring exceeds 40 m – branch wiring to be a minimum of No. 8 AWG.

.3 The entire length of the circuit wiring exceeds 60 m – branch wiring to be a minimum of No. 6 AWG.

3.1.11. Where feeders or branch circuits are run underground, upsize conductors to comply with the requirements of electrical code Rule 4-004, Ampacity of wires and cables, using Diagrams D8 to D11 and Tables D8A to D11B of the electrical code. Where conductors are upsized due to Tables D8A to D11B, upsize conduits to comply with the requirements of electrical code Rule 12-910, Conductors and cables in conduit and tubing.

3.1.12. Where one (1) hour or two (2) hour conductor fire rating is indicated on the Drawings, provide fire rated Mineral-Insulated cables or fire rated MC cables. Fire rated Mineral-Insulated and MC cables shall be installed in accordance with the manufacturer's installation instructions and the fire rated cable product listing in order to maintain their fire rating. Special attention shall be paid to cable supporting method and fire rating of the structure from which the cables are supported.

3.1.13. Where conductors supply power to emergency lighting and the emergency lights are located on a different floor level than the power source (i.e. panel), then the conductors shall be fire rated for at minimum one (1) hour using fire rated Mineral-Insulated cables. Conductors with two (2) hour fire rating shall be used where indicated on Drawings. Provide fire rated Mineral-Insulated cables or fire rated MC cables where conductors require fire ratings.

3.1.14. Where alternatives to fire rated cables are indicated on the Drawings, such as running conduits within concrete cast in place slabs, under concrete slabs on grade, or within fire rated shaft/riser, care must be taken to ensure that the required fire rating is maintained. Where drawings call for conduits to be run within concrete cast in place slabs, the slabs must be of sufficient thickness to achieve the required fire rating and be no less than 51 mm (2 in.) of concrete cover both above and below conduits where one (1) hour fire rating is required and 102 mm (4 in.) concrete cover both above and below conduits where two (2) hour fire rating is required. The contractor shall submit a letter confirming the concrete coverage or construction of fire rated assembly provides the sufficient fire rating of the enclosed conduits.

3.1.15. 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. Conduit to be sized to the electrical code unless noted on the drawings or in the specifications.

3.2.2. All conductors are to be colour coded. Provide colour tape at all terminations to identify all conductors in each run.

3.3. INSTALLATION OF TECK 90 CABLE, VARIABLE FREQUENCY DRIVE CABLE, 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 installation instructions.

3.3.3. Fastenings:

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

.2 Channel type supports for two or more cables.

.3 Galvanized threaded rods: 6 mm diameter minimum to support suspended channels.

.4 Pre-engineered support systems complying with CSA C22.2 No. 18.4 “Hardware for the support of conduit, tubing, and cable (Bi-national standard with UL 2239).”

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. INSTALLATION OF MINERAL-INSULATED AND FIRE RATED MC CABLES

3.4.1. Handling:

.1 Cable shall be uncoiled by rolling or rotating supply reel. Do not pull from coil periphery or centre.

3.4.2. Bending:

.1 Not less than six (6) times the cable diameter for cable not more than 250 kcmil.

.2 Not less than twelve (12) times the cable diameter for cable diameter for cable more than 350 and 500 kcmil.

3.4.3. Splicing:

.1 Make all fire rated splices in the factory. In the event that a field splice is necessary, have the manufacturer’s field technician make it in the field.

3.4.4. Terminations:

.1 Make field made terminations using the cable manufacturer’s termination kits. Use stripping tools, crimping tools and compression tools, available from the manufacturer for proper cable termination.

.2 Connections to ferrous cabinets for single conductor cables shall incorporate brass plates. Install per manufacturer’s drawing.

.3 At cable terminations, use thermoplastic sleeving over bare conductors.

3.4.5. Sheath induction reduction:

.1 When multi-phase circuits have paralleled single conductors, run cables in groups having one of each phase in each group.

.2 Separate each set of paralleled conductors by at least two single cable diameters.

3.4.6. Exposed or Surface Installations:

.1 Cable shall be secured directly to fire rated building structure using:

.1 Straps: 13 mm wide x 38 mm long by 0.75 mm thick stainless steel or copper straps. Each strap shall contain two 5 mm-holes for securing with 5 mm by minimum 44 mm long steel anchors.

.2 Support 2 hr fire rated cables at 1 m intervals.

3.4.7. Wall or floor penetrations:

.1 Provide approved fire stopping of all penetrations.

.2 Neatly train and lace cable inside boxes, equipment, and panelboards.

.3 Where cables are buried in cast concrete or masonry, sleeve for entry of cables.

.4 When penetrating a fire rated wall or fire rated floor, the cable must extend a minimum of 305 mm beyond the fire rated wall or fire rated floor. The 305 mm dimension can be in any direction as 305 mm of cable length is required to allow for proper heat dissipation such that cable terminations do not overheat.

3.5. FIELD QUALITY CONTROL

3.5.1. 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.

3.5.2. All Wires and Cables to be tested on site as defined in Section 26 08 01.00 – TECHNICAL SERVICES DIVISION STARTUP SERVICE and herein. Contractor to oversee all testing and correct any deficiencies noted.

3.6. INSTALLATION OF CONTROL CABLES

3.6.1. Install control cables in conduit.

3.6.2. Ground control cable shield.

END OF SECTION

26 05 26.00 Grounding + Bonding

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 Building Code, latest edition.

1.2.3. CAN/ULC-S115, Fire Tests of Fire Stop Systems, latest edition.

1.2.4. 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 shop drawings for ground bars and ground rod inspection wells for engineer's review prior to manufacture.

1.4.3. Submit main system ground test report as a shop drawing for engineer's review. Include final reviewed report in the project O&M manuals.

2. Products

2.1. GROUNDING & 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 to be made with compression type fittings and lugs with lug 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, to conform to requirements of local authority having jurisdiction over installation.

3.1.2. Provide main station ground grid as shown on drawing but the ground grid shall consist of a minimum of four (4) driven ground rods.Copper ground rods shall be not less than 3 m long and 19 mm in diameter and where practicable located adjacent to the equipment to be grounded (i.e. main electrical room). Interconnect all ground rods underground with a #2/0 AWG bare ground conductor.

.1 If main ground grid cannot be installed directly below the main electrical room, then provide a remote ground grid by installing the ground rods at the lowest floor level of the building and provide two grounding conductors of a minimum of #4/0 AWG copper to connect the ground grid to the main electrical room equipment. Run the two conductors through separate routes separated by a minimum of 5 m.

3.1.3. Supply and install a new ground bus system consisting of a length of copper bus, 25 mm thick ebony pad with chamfered edges as shown on the drawings. A minimum of two 1200 mm ground bars are to be provided in transformer vault(s), main electrical room(s) and generator room(s). Where a perimeter ground bus is shown on the drawings, supply and install a 50 mm x 6 mm copper bus on all walls attached at 1.5 m intervals on 13 mm standoffs. The perimeter ground bus shall be continuous around the room and shall be continued above or below all openings such as doors and vents.

3.1.4. Interconnect the ground bars to the ground grid with a minimum #2/0 AWG bare copper ground conductor if the ground grid is adjacent to the main electrical room(s). Where the ground grid is remote, connect the ground bars to the remote ground grid as described in 3.1.2.(1) above.

3.1.5. Supply and install inspection box for each ground rod. Inspection box is to be suitable for installation in heavy traffic areas and is to come complete with a lockable lid and security key.

3.1.6. Connect to the ground bus all metal equipment enclosures, as well as all other metal parts such as mechanical pipes, ducts, waste lines, door frames, railings, grilles, fences, etc. with minimum #2/0 AWG bare copper conductors.

3.1.7. For solidly grounded systems, transformer neutrals, main service entrance switchboard neutrals and all similar bonding connections, the bonding conductors shall be sized in accordance with Table 16 of the Electrical Code.

3.1.8. Provide cable grips to receive all grounding conductors. Identify all grounding conductors at the ground pad using lamacoid nameplates. Ground bus system to be provided in rooms as shown.

3.1.9. Terminate the following conductors at the ground bus system:

- Service neutral -as indicated on drawings

- Telecommunications ground -as per TIA Standard 607, 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

3.1.10. Ground all metallic water, gas, and waste systems with a minimum #6 AWG copper in accordance with code requirements.

3.1.11. 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.

3.1.12. 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 engineer's review. Provide a copy of the report in the maintenance manual. (Refer to Part 3.2).

3.1.13. Install connectors in accordance with manufacturer's instructions.

3.1.14. Ground rods to be interconnected by grounding grid conductors (sized as per sections above) and buried to a maximum depth of 600 mm below the rough station grade and a minimum depth of 150 mm below the finished station grade.

3.1.15. Protect exposed grounding conductors from mechanical damage.

3.1.16. 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.

3.1.17. Provide separate, insulated bonding conductor within each feeder and branch circuit raceway.

3.1.18. Interface with the lightning protection system, if one is installed for this building.

3.2. TESTING

3.2.1. The contractor shall pay for the testing and verification of the entire building ground system using a certified testing Agency. Tests shall include main ground grid and ground rods, and grounding connections between all electrical and communication rooms. The agency shall provide complete test reports indicating test methodology and results. All costs shall be included in contract bid.

3.2.2. 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

# 26 05 29.00 Hangers and Supports

## 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 the Electrical division shall be complete with all necessary supports and hangers required for a safe and workpersonlike installation.

## 2. Products

### 2.1. MATERIALS

2.1.1. Provide “U” type support Strut as manufactured by Unistrut.

## 3. Execution

### 3.1. INSTALLATION

3.1.1. All drilling for hangers, rod inserts and work of similar nature shall be done by this Division.

3.1.2. 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.

3.1.3. Depending on type of structure, hangers shall be either clamped to steel beams or joists, or attached to approved concrete inserts.

3.1.4. Approved type expansion shields and bolts may be used for conduit up to 103 mm diameter where the pre-setting of concrete inserts is not practical. Submit Shop Drawings.

3.1.5. Suspension from metal deck shall not be allowed unless specifically accepted by the Engineer’s Representative. Drawings of the proposed method of suspension must be submitted for review.

3.1.6. Hangers, hanger rods and inserts in all parking and ramp areas shall meet the requirements of CAN/CSA-S413 – Parking Structures (latest edition) and shall be of corrosion-resistant material or have an effective, durable corrosion resistant coating. Submit samples for approval.

3.1.7. Suspending one hanger from another shall not be permitted.

3.1.8. All hangers, supports, brackets and other devices used outside the building wall shall be galvanized. If galvanized components cannot be used submit samples of proposed substituted for review before installation.

3.2. HORIZONTAL RUNS ON THE ROOF

3.2.1. Where conduit or cables are run horizontally across a roof, conduit or cable shall be supported from pre-manufactured UV resistant sleepers with closed cell foam base.

3.2.2. Sleepers shall be “E-Z Sleeper” product from Pipe-Ease Inc. or approved equivalent.

3.2.3. Wood Blocks are not acceptable.

END OF SECTION

# 26 05 31.00 Splitters, Junction, Pull Boxes and Cabinets

## 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.

1.2.2. Ontario Building Code, latest edition.

1.2.3. CAN/ULC-S115, Fire Tests of Fire Stop Systems, latest edition.

### 1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit shop drawings and product data for cabinets in accordance with specification 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. Lugs to be dual rated for Copper/Aluminum (Cu/Al).

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 is to 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.

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

# 26 05 32.00 Outlet Boxes, Conduit Boxes and Fittings

## 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 electrical 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. 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. CONCRETE BOXES

2.4.1. Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5. FLOOR BOXES

2.5.1. 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.

2.5.2. Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16 mm and 21 mm conduit. Minimum size: 73 mm deep.

2.6. OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

2.6.1. 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.

2.7. FITTINGS - GENERAL

2.7.1. Bushing and connectors with nylon insulated throats.

2.7.2. Knock-out fillers to prevent entry of debris.

2.7.3. Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

2.7.4. Double locknuts and insulated bushings on sheet metal boxes.

2.8. SERVICE FITTINGS

2.8.1. '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.

2.8.2. Pedestal type 'low tension' fitting made of 2 piece die cast aluminum with brushed aluminum housing finish to accommodate Amphenol jack connectors.

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 allowed.

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 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

26 05 34.00 Conduits, Conduit Fasteners and Fittings

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 on centre.

2.2.4. Hot dipped galvanized threaded rods, 6 mm dia. minimum, to support suspended channels.

2.2.5. For non-fire rated applications, pre-engineered support systems complying with CSA C22.2 No. 18.4 “Hardware for the support of conduit, tubing, and cable (Bi-national standard with UL 2239).”

2.3. CONDUIT FITTINGS

2.3.1. Fittings: manufactured for use with conduit specified. Coating: same as conduit.

2.3.2. Factory 90 degree elbow 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 35 mm 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.Conduits are not allowed in cast in-place concrete or concrete slabs unless written consent is received from the Engineer’s Representative and Owner. Only once approved by the Engineer’s Representative and Owner do the clauses contained within this section and the respective sections relating to conduits in cast in-place concrete or concrete slabs 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. Do not install conduits, associated raceway system, or devices on the surface of, or within 100 mm of the underside of roof decks.

3.1.4. Conceal conduits except in mechanical and electrical service rooms or in unfinished areas. Conduits to have their own support system and are to be supported independently of the ceiling grid or ceiling support system.

3.1.5. Where vertically run conduit passes through a slab, Contractor to provide a 100 mm high concrete pad with the pad extending 100 mm on all sides of the conduit.

3.1.6. Use electrical metallic tubing (EMT) conduit except where specified otherwise.

3.1.7. Use epoxy coated conduit in corrosive areas.

3.1.8. Use rigid galvanized steel threaded conduit where conduit is subject to mechanical damage.

3.1.9. Use rigid PVC conduit underground or in corrosive areas and where indicated.

3.1.10. Use flexible metal conduit for connection to motors or vibrating equipment in dry areas, connection to recessed luminaires without a prewired outlet box, connection to surface or recessed luminaires and work in movable metal partitions. Ensure slack is provided in wiring connections to equipment which contains moving parts.

3.1.11. 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 to have a jacket with an FT6 rating when used in plenums otherwise provide a minimum FT4 rating. Ensure slack is provided in wiring connections to equipment which contains moving parts.

3.1.12. Use explosion proof flexible connection for connection to explosion proof motors.

3.1.13. Install conduit sealing fittings in hazardous areas. Fill with compound.

3.1.14. Minimum conduit size for lighting and power circuits: NPS 21 mm, unless otherwise noted on the Drawings.

3.1.15. Minimum conduit size for data / voice cabling: as indicated on drawings, otherwise 27 mm.

3.1.16. Install EMT conduit from a raised floor branch circuit panel to outlet boxes located in sub floor.

3.1.17. 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.

3.1.18. Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

3.1.19. Mechanically bend steel conduit over 21 mm diameter.

3.1.20. Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

3.1.21. Install fish cord in empty conduits.

3.1.22. Run two 27 mm spare conduits up to ceiling space and two 27 mm 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.

3.1.23. Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

3.1.24. Dry conduits out before installing wire.

3.1.25. All cutting and patching of masonry/concrete floors, walls, and roof for electrical services shall be by this Division. Obtain approval from the Landlord and/or structural Engineer's Representative before cutting any structural walls or floors. Cutting and drilling shall only be at times allowed by the Landlord. 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 Landlord and/or structural Engineer's Representative.

3.1.26. Provide sleeves for all new conduit passing through floor and roof slabs, beams, concrete walls and slab to slab partitions, etc.

3.1.27. 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.

3.1.28. 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.

3.1.29. 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. Provide photo and video evidence of compliance with this clause and send to Engineer's Representative for review within 24 hours of Work occurring.

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.

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 27 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

26 05 53.00 Identification

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.

1.2.2. Ontario Building Code.

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 mmhigh 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.

.9 Sample:

| |
|---|
| SWITCHBOARD AA |
| 3000A, 600/347V, 3 PH, 4W, 50kA |
| FED FROM SWITCHBOARD AAA |
| MANUFACTURED IN MM/YYYY; SERIAL NUMBER ##-#### |

.10 Wording on nameplates to be approved by Engineer’s Representative prior to manufacture.

.11 Nameplates for splitters, terminal cabinets, grid boxes, pull boxes, and junction boxes are to indicate the system and/or voltage characteristics.

.12 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.13 Transformers: indicate capacity, primary and secondary voltages, and upstream source where Transformer is fed from.

.14 Mechanical equipment: indicate equipment name and full circuit number including panel board identification.

.15 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.

.16 Automatic Transfer Switches (ATS): Name designation, rated ampacity, voltage, transfer switch arrangement (e.g. 3 pole with no neutral, 3 pole with solid neutral, 3 pole with overlapping neutral, 4 pole), withstand rating in units of kA, upstream normal power source from which ATS is fed, upstream emergency power source from which ATS is fed, month and year manufactured, and serial number.

.17 Generators:

.1 Indicate kW rating, kVA rating, voltage, number of phases, number of wires, generator neutral grounding arrangement, year and month manufactured, and engine and alternator serial number.

.2 Indicate Maximum Site Design Load (as defined in CSA C282) in units of kW; engineering firm responsible for Maximum Site Design Load calculation; drawing number, issuance title (e.g. Issued for Construction, Electrical Contactor As-Built, Issued for CCN-E01,etc.), and issuance date which Maximum Site Design Load is based on. It is very important for future renovations and load additions that it is clear when the Maximum Site Design Load is from and what drawing it is based on.

.3 Sample nameplate:

| |
|---|
| Generator G1 |
| 600 kW / 750 kVA |
| 600/347V, 3 PH, 4W, Wye solidly grounded |
| Connected to ATS-PHXA |
| MANUFACTURED IN MM/YYYY; SERIAL NUMBER ##-#### |
| Maximum Site Design Load 420 kW |

.18 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 Automatic Transfer Switches

.6 Generators

.7 UPS equipment

.8 Lighting control systems

2.1.2. Labels:

.1 A printed label, similar to a Brady label 6 mm high letters unless specified otherwise, 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 electrical 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:

.1 up to 250 V Normal Power = Green

.2 up to 600 V Normal Power = Blue

.3 up to 250 V Emergency Power = Black

.4 up to 600 V Emergency Power = Orange

.5 High Voltage, greater than 750 V = Large independent label clearly identifying the voltage

.6 Telephone/Data = White

.7 Fire alarm = Red

.8 Other security systems = Yellow

.9 Controls = Purple

2.4. RECEPTACLE IDENTIFICATION

2.4.1. For health care projects, conform to requirements of Section 26 05 21.01 – PATIENT CARE WIRING.

2.4.2. 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 12 mm characters. Circuit number to include full circuit number including panel board identification.

2.4.3. Label to be placed on wall above cover plate or on cover plate. Location of label to be consistent throughout 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 Inspection Authorities.

2.7. FUSE SIZE LABELLING

2.7.1. Contractor to 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. Contractor to 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

# 26 05 83.00 Sleeves

## 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. Sleeves passing through stud partitions shall be 0.75 mm 22 US Gauge steel.

2.1.2. Sleeves passing through masonry walls shall be Schedule 40 steel pipe.

2.1.3. Sleeves passing through floors in finished areas and concealed spaces may be sheet metal or factory fabricated reusable type.

2.1.4. Where a housekeeping pad cannot be installed, sleeves passing through floors with waterproof membrane shall have a flashing collar, 50 mm wide at the membrane level. Flashing collar shall be continuously welded to sleeve. Sleeves shall extend 50 mm above the finished floor and shall be Schedule 40 steel pipe.

2.1.5. Where conduits pass through exterior foundation walls 6 mm thick steel sleeve of inside diameter not less the 75 mm greater than the outside diameter of the pipe shall be used and shall be complete with anchor collar. Thunderline Link-Seal wall seal or approved equal shall be used for the annular space between the sleeve and the conduit. A reinforced concrete bridge shall be installed between the wall and the adjacent undisturbed soil.

2.1.6. Provide adequate bracing for support of sleeves during concrete and masonry work.

2.1.7. Unless otherwise specified on the drawings, sleeves passing through the roof shall be liquid tight flexible conduit flashing consisting of a gooseneck shaped aluminum flashing sleeve with an integral deck flange, EPDM end cap seal and EPDM base seal.

## 3. Execution

### 3.1. INSTALLATION

3.1.1. Arrange for all chases and formed openings in walls and floors as required by the Electrical Division for the Electrical services. These chases and openings shall not be larger than necessary to accommodate the equipment and services. Advise on these requirements well in advance, before the concrete is poured and the walls are built. All necessary sleeves and inserts shall be supplied by this Division.

3.1.2. Chases and openings not located in accordance with the above provisions shall be made at the expense of this Division. Cutting of structural members shall not be permitted without specified written acceptance of the Engineer’s Representative.

3.1.3. Provide sleeves for all service penetrations through walls, partitions, floor slabs, plenums and similar barriers. At non-rated barriers fill the annular space between the service and the sleeve with fire rated insulation as specified for rated separations and caulk around the edges with a minimum 12 mm thick of fire rated compound or acoustic non-setting mastic.

3.1.4. Through all fire or smoke separations, after testing, the annular space between conduit sleeves shall be fire stopped.

3.1.5. Where-holes are to be installed in existing structure, contractor is to core drill the-holes required. Contractor is required to scan all areas prior to coring and confirm layout with structural engineer prior to completing work. When installing sleeves in existing structures, sleeves shall be provided as specified complete with a combination puddle/anchor flange bolted to the floor. Seal watertight between the flange and the floor.

3.1.6. All sleeves are to extend 150 mm above finished floor to accommodate a 100 mm concrete pad. Contractor to pour the concrete pad with the pad extending 100 mm on all sides of the sleeve.

END OF SECTION

26 05 88.00 Cutting and Patching

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 Div. 00, and Section 26 05 01.00, and shall be carried out by experienced workers.

2.1.2. Include for 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 structural Engineer's Representative 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 x-ray the structure to obtain Structural Engineer's Representative'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. X-ray scanning:

.1 X-rays shall be performed by a qualified technician, in a safe manner and in accordance with all applicable regulations governing this activity. The company shall be licensed by the Canadian Nuclear Safety Commission (CNSC), and all radiography work shall be performed in accordance with the Nuclear Safety and Control Act.

.2 Follow any safety requirements stipulated by the property manager.

.3 Minimum requirements: All people must be evacuated within a radius of 10 m from each exposure location. Prior to conducting exposures verify this "safe zone". If the 10 m radius includes public areas such as a sidewalk, lobby, or elevator, these areas must be

controlled (e.g. elevators shut down or prevented from stopping on floors at which exposures are taking place). In addition, if exposure locations are near the walls of adjacent tenants, ensure the notification and evacuation of people within the 10 m radius. The 10 m radius applies to the camera floor and the floor directly below only. The qualified technician shall ensure adequate precautions for the additional floors above and below the camera floor.

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, is part of this division work.

3.1.7. The cost of x-ray scanning, cutting, patching and finishing is included in this division contract.

END OF SECTION

# 26 12 17.00 Dry Type Transformers – 600V Primary

## 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.

### 1.2. REFERENCE

1.2.1. CSA C22.2 No. 47, Air-Cooled Transformers (Dry-Type), latest edition.

1.2.2. CSA C802.2, Minimum Efficiency Values for Dry Type Transformers, latest edition.

1.2.3. U.S. Department of Energy (DOE) “DOE 2016 Efficiency”, latest edition.

1.2.4. Natural Resource Canada Regulation SOR/2018-201 (NRCAN 2019), latest edition.

.1 Electricity Act, 1998 Regulation 509/18 Energy and Water Efficiency – Appliances and Products, latest edition.

1.2.5. CSA C9, Dry-Type Transformers, 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.

### 1.4. STORAGE

1.4.1. Store and handle in strict compliance with manufacturer’s instructions and recommendations. Protect from potential damage from weather and construction operations. Store so condensation will not form on or in the transformer housing and if necessary, apply temporary heat where required to obtain suitable storage or service conditions.

1.4.2. Handle transformer using proper equipment for lifting and handling, use necessary lifting eye and/or brackets provided for that purpose.

### 1.5. WARRANTY

1.5.1. The transformer shall carry a 1 year warranty from the time of substantial completion.

## 2. Products

### 2.1. TRANSFORMERS

2.1.1. Use transformers of one manufacturer throughout project.

2.1.2. Design

.1 Type: ANN. All transformers to be delta-wye configuration unless otherwise noted on the drawings. Scott T constructed transformers will not be accepted.

.2 3 phase, kVA and voltages as indicated on the plans, 60 Hz.

.3 Provide voltage taps of 2 ± 2 ½% FCAN (full capacity above normal) & FCBN (full capacity below normal).

.4 Insulation: Class 220 deg. C (former designation: Class H), 150 deg. C. or less temperature rise.

.5 All windings are to be copper unless stated otherwise on the contract documents.

.6 Basic Impulse Level (BIL): standard.

.7 Hipot: standard.

.8 Average sound level to comply with the latest edition of CSA C9 for the appropriate voltage class.

.9 Impedance at 60 Hz: minimum impedance as shown in the table below.

| Transformer size | Minimum impedance (%Z) |
|---|---|
| Up to 75 kVA | 2.5 % |
| 112.5 to 150 kVA | 4 % |
| 151 to 300 kVA | 4 % |
| 301 to 600 kVA | 5 % |
| 601 to 2500 kVA | 6 % |
| Greater than 2500 kVA | Per CSA C9 |

.10 Provide minimum K-4, K-rated transformers unless otherwise indicated on the drawings.

.11 Enclosure: CSA Type 3R, removable metal front panel.

.12 Mounting: floor or wall, as indicated.

.13 Transformer to meet energy efficiency requirements of the energy efficiency standards referenced in this specification, whichever is more stringent, at35% of rated load unless shown otherwise on drawings.

.14 Finish: in accordance with Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2.2. ACCESSORIES

2.2.1. Provide analogue type winding temperature indicator with 2 sequence contacts for transformers of 225 kVA and larger. Provide sensor in the centre winding to monitor the temperature.

2.2.2. Grounding terminal: inside enclosure.

2.2.3. External vibration pads equal to Mason Super ‘W’.

2.2.4. Nameplate shall be stainless steel.

2.3. EQUIPMENT IDENTIFICATION

2.3.1. Provide equipment identification in accordance with Section 26 05 53.00 – IDENTIFICATION.

2.3.2. Label size: 6 mm letters.

2.4. FINISH

2.4.1. Finish enclosure exterior in accordance with Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2.4.2. Transformer to be painted ANSI-61 grey.

2.5. MANUFACTURERS

2.5.1. The following are acceptable manufacturers:

.1 Hammond Power Solutions

.2 Delta Transformers

.3 Schneider-Electric

.4 Eaton Cutler-Hammer

.5 Rex Power Magnetics

.6 STI Power

.7 Siemens

3. Execution

3.1. INSTALLATION

3.1.1. Mount dry type transformers as indicated. Transformers larger than 75kVA are to be floor mounted unless identified otherwise. Where a transformer larger than 75kVA is shown as mounted off the floor, the Contractor is to provide an engineered structure from the floor and wall to support the transformer. Structure to be stamped and signed by a professional engineer and submitted as a shop drawing. Design of structure to take into account the building structure within the respective room.

3.1.2. Provide external vibration isolation pads under transformer.

3.1.3. Ensure adequate clearance around transformer for ventilation. Install transformer to meet ventilation clearance requirements given by transformer manufacturer. Where transformer manufacturer does not have requirements, follow clearances required by the local electrical code.

3.1.4. Install transformers in level upright position.

3.1.5. Remove shipping supports only after transformer is installed and just before putting into service.

3.1.6. Loosen isolation pad bolts until no compression is visible.

3.1.7. Make primary and secondary connections with flexible conduit and in accordance with wiring diagram.

3.1.8. Energize transformers after installation is complete.

END OF SECTION

# 26 24 17.00 Panelboards – Breaker Type

## 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.

1.3.3. Submit initial power system study at the same time as shop drawings for electrical distribution equipment, such that the Engineer can review the adequacy of equipment interrupting capacity or withstand ratings, prior to equipment being released for manufacture. In situations where the entire study cannot be submitted with the electrical distribution shop drawings, submit at a minimum a preliminary short circuit study for review.

## 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.

.1 120/208 V panelboards – 10 kA

.2 347/600 V panelboards – 22 kA

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.

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, for all panelboards other than those used in residential suites.

2.1.12. Trim and door finish: baked grey enamel.

2.1.13. Enclosure to be CSA Type 1 with drip hood with the exception of recessed panel enclosures which are to be CSA Type 1.

2.1.14. Provide Surge Protection Device where shown on Drawings.

2.1.15. Series ratings may be acceptable. Panels to be labeled as such. Manufacturing to supply supporting data.

2.1.16. All lugs to be dual rated for Copper/Aluminum (Cu/Al).

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: 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.

2.2.8. Breaker terminals to be dual rated for Copper/Aluminum (Cu/Al).

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

.2 Eaton Cutler-Hammer

.3 Siemens

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

26 24 18.00 Panelboards – Switch and Fuse Type

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. 39 – Fuse holder assemblies, 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 and dimensions of panel, branch switch type, ampacity and quantity.

1.3.3. Submit initial power system study at the same time as shop drawings for electrical distribution equipment, such that the Engineer can review the adequacy of equipment interrupting capacity or withstand ratings, prior to equipment being released for manufacture. In situations where the entire study cannot be submitted with the electrical distribution shop drawings, submit at a minimum a preliminary short circuit study for review.

1.4. PLANT ASSEMBLY

1.4.1. Assemble panelboard interior before shipment. Ship fuses loose for on-site installation.

1.4.2. In addition to CSA requirements, manufacturer's nameplates must show fault current that panelboard has been built to withstand.

2. Products

2.1. CONSTRUCTION FEATURES

2.1.1. Panelboards: product of one manufacturer.

2.1.2. Sequence phase bussing with odd numbered sections on left and even on right, with each section identified by permanent number identification as to circuit number and phase.

2.1.3. Panelboards with mains, number of circuits, and number and size of branch sections 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.

2.1.4. 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. Two keys for each panelboard and key panelboards alike.

2.1.6. Copper bus with neutral sized to 200% of the mains rating.

2.1.7. Suitable for bolt-on fusible sections.

2.1.8. Trim and door finish: baked grey enamel.

2.1.9. Enclosure to be CSA Type 1 with drip hood.

2.1.10. Fusible pull-outs or door-operated type switches not acceptable.

2.1.11. Fuse clips: suitable for HRC type J fuses.

2.1.12. All lugs and switch terminals to be dual rated for Copper/Aluminum (Cu/Al).

2.2. CUSTOM BUILT PANELBOARD ASSEMBLIES

2.2.1. Double stack panels as indicated.

2.2.2. Contactors in mains as indicated.

2.2.3. Feed through lugs as indicated.

2.3. EQUIPMENT IDENTIFICATION

2.3.1. Provide equipment identification in accordance with Section 26 05 53.00 – IDENTIFICATION.

2.3.2. Nameplate for each panel engraved in 8 mm high letters.

2.3.3. Nameplate for each circuit in distribution panels engraved "name of load" as indicated in 5 mm high letters.

2.3.4. Complete circuit directory with typewritten legend showing location and load of each circuit. Install circuit directory under plastic protective cover on front of panel.

2.3.5. Provide a lamacoid for each fused circuit that indicates the replacement fuse size.

2.4. MANUFACTURERS

2.4.1. The following are acceptable manufacturers:

.1 Schneider Electric

.2 Eaton Cutler-Hammer

.3 Siemens

3. Execution

3.1. INSTALLATION

3.1.1. Locate panelboards as indicated and mount securely, plumb, and square, to adjoining surfaces.

3.1.2. Install surface-mounted panelboards on plywood backboards. Where practical group panelboards on common backboard. The plywood backboards are to be as per Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

3.1.3. Mount panels 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.

END OF SECTION

26 27 26.00 Wiring Devices

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. REFERENCES

1.2.1. CSA C22.2 No. 42, General use receptacles, attachment plugs, and similar wiring devices, 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. 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 to be selected by Architect/Engineer’s Representative.

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 to be specification grade.

2.2.2. Duplex 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. Duplex receptacles with USB charging outlets, 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 Six back wired entrances, four side wiring screws.

.4 Triple wipe contacts and riveted grounding contacts.

.5 One USB A charging outlet and one USB C charging outlet, 5 V DC, 6 A shared between the two ports.

2.2.4. Hospital grade receptacles: As indicated in Section 26 05 21.01 – PATIENT CARE WIRING.

2.2.5. 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.

2.2.6. Other receptacles with ampacity and voltage as indicated.

2.2.7. Receptacles to be coloured as follows:

.1 Normal Power – Colour to be selected by Architect/Engineer's Representative.

.2 Emergency/Essential Power – Red.

.3 Isolated Ground – Orange.

.4 Switched – Gray.

.5 UPS – Blue.

2.2.8. 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 required to be tamper-resistant.

2.2.9. All dwelling receptacles rated 125V, 20A or less shall be provided with arc-fault protection, except for the following:

.1 Bathroom and washroom basin receptacles.

.2 Kitchen counter receptacles

.3 Refrigerator receptacles

2.2.10. Arc-fault protection for dwelling unit receptacles shall be provided by:

.1 A combination-type arc-fault circuit interrupter

.2 An outlet branch-circuit interrupter installed at the first outlet on the branch circuit, where the wiring method for the portion of branch circuit between the branch circuit overcurrent device and the first outlet consists of metal raceway, armoured cable, or non-metalic conduit or tubing.

2.2.11. Electrical Contractor shall coordinate with 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:

.1 Legrand.

.2 Hubbell.

.3 Cooper.

.4 Leviton.

2.4. DIMMERS

2.4.1. Dimmers shall be 600 W, 1500 W, 2000 W.

.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. 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 600 W of Electronic Low Voltage load.

.3 Reset-able overload protection when capacity is exceeded.

2.4.3. LED dimmers.

.1 Slide to Off only. Must match driver and LED requirements.

2.4.4. Manufacturers

.1 Lutron Maestro Series.

.2 Leviton True Touch Series.

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 stainless steel 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.

2.6.7. Weatherproof rain tight while-in-use metal cover, complete with gaskets for single receptacles or switches located outside or as indicated.

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 Where line voltage controls are used, install an identified conductor at each location of a manual or automatic control device in accordance with electrical code requirements.

.4 Mount toggle switches at height specified in Section 26 05 05.00 – MOUNTING HEIGHTS or as indicated.

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.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

3.1.3. Dimmers:

.1 Install dimmers as indicated. 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 Where line voltage controls are used, install an identified conductor at each location of a manual or automatic control device in accordance with electrical code requirements.

3.1.4. Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

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

26 28 14.00 Fuses Low Voltage

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. 248, Low Voltage Fuses, 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. 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 Fuses: product of one manufacturer.

2.1.2. 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 R fuses. For UL Class RK1 fuses, peak let-through current and I2t values not to exceed limits of CSA C22.2 No. 248.

.1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.

.2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.

.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

2.2.4. Class C fuses.

2.2.5. Fuses for Motors:

.1 All fuses for motor loads are to be time-delay type.

2.3. FUSE STORAGE CABINET

2.3.1. Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door, B-LINE model 243012 + 2 shelves FCS2412, finished in accordance with Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

2.4. FUSE PULLER

2.4.1. Provide a fuse puller for each size of fuse to be located in the fuse storage cabinet. Fuse puller to be clearly labelled for the appropriate building and fuse cabinet. Fuse puller to be equal to the Ideal Safe-T-Grip Fuse Puller.

2.5. MANUFACTURERS

2.5.1. The following are acceptable manufacturers:

.1 Mersen

.2 Cooper-Bussman

.3 Littelfuse

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 physically match mounting devices.

.1 Install Class R rejection clips for Class R fuses.

3.1.3. Ensure correct fuses fitted to assigned electrical circuit.

3.1.4. Where UL Class RK1 fuses are specified, install warning label "Use only UL Class RK1 fuses for replacement" on equipment.

END OF SECTION

# 26 28 21.00 Moulded Case and Insulated Case Circuit Breakers

## 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 400 A and over or with interrupting capacity of 22,000 A symmetrical (RMS) and over at system voltage.

1.3.3. Submit initial power system study at the same time as shop drawings for electrical distribution equipment, such that the Engineer can review the adequacy of equipment interrupting capacity or withstand ratings, prior to equipment being released for manufacture. In situations where the entire study cannot be submitted with the electrical distribution shop drawings, submit at a minimum a preliminary short circuit study for review.

## 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.

### 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. Circuit breaker to operate by means of an adjustable solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition.

2.5.2. Electronic trip with true RMS sensing.

2.5.3. Use current transformers to ensure accurate measurement from low current up to high currents.

2.5.4. Electronic trip with thermal memory/imaging.

2.5.5. Adjustable solid state trip unit complete with:

.1 Adjustable long time pick-up

.2 Adjustable long time delay

.3 Adjustable short time pick-up (where S indicated on Drawings)

.4 Adjustable short time delay (where S indicated on Drawings)

.5 Adjustable instantaneous pick-up (where I indicated on Drawings)

.6 Adjustable ground fault pick-up (where G indicated on Drawings)

.7 Adjusable ground fault delay (where G indicated on Drawings)

.8 Long time, short time, instantaneous tripping for phase and ground fault short circuit protection as noted above.

2.5.6. Trip unit consisting of adjustable protection settings set by rotating switch or digital keypad, and rating plug.

2.5.7. Provide features listed below:

.1 Provide instantaneous maintenance mode (arc flash reduction maintenance system) including settings as low as 2.5 times breaker rating plug with switch built into respective switchboard. Provide LED light that confirms that maintenance mode is engaged.

.2 Provide instantaneous maintenance mode (arc flash reduction maintenance system) including settings as low as 2.5 times breaker rating plug, enabled remotely through 24 V DC circuit and remote switch. Provide LED light that confirms that maintenance mode is engaged.

.3 Provide trip unit with local trip indication and ability to locally and remotely indicate reason for trip (e.g. overload, short circuit, or ground fault).

2.6. INSULATED CASE CIRCUIT BREAKERS GENERAL

2.6.1. Use insulated case circuit breakers where shown on the Drawings.

2.6.2. Provide draw out type electrically operated circuit breaker with remote open/close key switch.

2.6.3. Provide circuit breaker operating mechanisms that are two-step, fully-stored energy devices for quick-make, quick-break operation with a maximum of a five-cycle closing time. Open-close-open (O-C-O) cycle possible without recharging. Provide motor operator that automatically charges when circuit breaker is closed. Charge the closing springs (step one) upon actuation of the operating handle or an operation cycle of the circuit breaker motor and close the circuit breaker contact (step two) upon operation of a local "close" button. Automaticaly charge the opening springs when closing the circuit breaker contacts.

2.6.4. Provide breaker that is 100 % continuous current rated in its enclosure.

2.6.5. Provide kirk keys where indicated on the Drawings.

2.6.6. Completely isolate current-carrying components from the accessory mounting area and double insulate current-carrying components from the operator with accessory cover in place.

2.6.7. Provide padlocking provisions furnished to receive up to three padlocks when circuit breaker is in the open position, positively preventing unauthorized closing of the circuit breaker contacts.

2.6.8. Provide provisions for up to two key locks allowing locking in the disconnected position. Provide provisions for locking in the connected, test and disconnected positions by padlock or key lock.

2.6.9. Provide buttons, with lockable clear cover, located on the face of the circuit breaker, to open and close the circuit breaker and indicators to show the position of the circuit breaker contacts, status of the closing springs, and circuit breaker position in the cell. Provide an indicator that shows "charged-not OK to close" if closing springs are charged but circuit breaker is not ready to close. Provide circuit breaker racking system that has positive stops at the connected, test, disconnected and withdrawn positions.

2.6.10. Equip circuit breaker with an interlock to discharge the stored energy spring before the circuit breaker can be withdrawn from its cell. Provide circuit breaker that provides a positive ground contact check between the circuit breaker and cell when the accessory cover is removed while the circuit breaker is in the connected, test or disconnected positions.

2.6.11. Provide interlocks to prevent circuit breaker draw out when in closed position and to prevent closing unless fully engaged or in test position. Provide breaker that is trip free during racking operation.

2.6.12. Provide as an option, primary connectors that can be rotated to provide flexible vertical or horizontal connections. Ensure front connections are available as an option for shallow depth equipment designs.

2.6.13. Provide ready-to-close contact that indicates remotely that the circuit breaker is "ready to close." The circuit breaker is ready to close when it is open, spring mechanism is charged, a maintained closing order is not present, a maintained opening order is not present, and the circuit breaker is in an operational position.

2.6.14. Provide secondary control wiring that is front accessible and available in cage clamp or ring terminal connections. Provide secondary wiring that is inaccessible when switchboard door is closed.

2.6.15. Provide long service life circuit breaker. Provide circuit breakers certified to perform a minimum of 10,000 operations without maintenance where circuit breaker frames are 3000 A and below.

2.6.16. Equip circuit breaker with a visual contact wear indicator.

2.6.17. Provide circuit breaker arc chutes that don’t contain asbestos.

2.6.18. Trip Unit

.1 Comply with the requirements noted above in the Solid State Trip Breakers section.

.2 Provide trip units that are removable to allow for field upgrades.

.3 Provide trip units that are capable of the following types of ground-fault protection: residual, zero sequence, source ground return, and modified differential. Ground-fault sensing systems may be changed in the field.

.4 Ensure neutral current transformers are available for four-wire systems.

.5 Provide trip units that have real time metering and metering functions that include current, voltage, power and frequency. Provide metering accuracy of 1.5 % current, 0.5 % voltage, and 2 % power. Accuracies listed are total system including CT and meter and are of reading, not full scale, in a range of 5 – 500 %.

.6 Provide trip unit with provisions for communications on a network.

2.7. ACCESSORIES

2.7.1. Include:

.1 shunt trip, when electrically operated or when indicated.

.2 auxiliary switches, when electrically operated or when indicated.

.3 motor-operated mechanism, when electrical operation indicated.

.4 on-off locking device.

.5 handle mechanism.

.6 Where a breaker serves a fire pump, the breaker is to come complete with auxiliary contacts that are to be monitored by the fire alarm system.

2.8. MANUFACTURERS

2.8.1. The following are acceptable manufacturers:

.1 Schneider Electric

.2 Eaton Cutler-Hammer

.3 Siemens

3. Execution

3.1. INSTALLATION

3.1.1. Install circuit breakers as indicated.

3.1.2. Contractor to wire any neutral CT’s to the breaker trip unit where required by the breaker ground fault detection system or as otherwise required by the manufacturers instructions.

END OF SECTION

# 26 28 23.00 Disconnect Switches – Fused and Non-Fused

## 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.

### 1.2. REFERENCE

1.2.1. CSA C22.2 No. 4 – Enclosed Switches, latest edition.

1.2.2. CSA C22.2 No. 39 – Fuse-holder Assemblies, 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. Submit initial power system study at the same time as shop drawings for electrical distribution equipment, such that the Engineer can review the adequacy of equipment interrupting capacity or withstand ratings, prior to equipment being released for manufacture. In situations where the entire study cannot be submitted with the electrical distribution shop drawings, submit at a minimum a preliminary short circuit study for review.

## 2. Products

### 2.1. DISCONNECT SWITCHES

2.1.1. Fusible, horsepower rated disconnect switch in CSA Type 3R enclosure, size as indicated.

2.1.2. Non-fusible, horsepower rated disconnect switch in CSA Type 3R enclosure, with minimum 10 kA Short Circuit Current Rating (SCCR), with manufacturer listed series rating with upstream breaker / fuse where available fault current exceeds 10 kA and with UL series rating label on disconnect switch, size as indicated.

2.1.3. Provision for padlocking in on-off switch position by three locks.

2.1.4. Mechanically interlocked door to prevent opening when handle in ON position.

2.1.5. Fuses: size as indicated, class J, current limiting, in accordance with Section 26 28 14.00 – FUSES - LOW VOLTAGE.

2.1.6. Fuse-holders: suitable without adaptors, for type and size of fuse indicated.

2.1.7. Quick-make, quick-break action.

2.1.8. 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 53.00 – IDENTIFICATION.

2.2.2. Indicate name of load controlled on nameplate.

2.2.3. Provide a Lamacoid nameplate 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.

.2 Eaton Cutler-Hammer.

.3 Siemens.

3. Execution

3.1. INSTALLATION

3.1.1. Install disconnect switches complete with fuses if applicable.

END OF SECTION

26 51 13.00 Lighting Equipment

1. General

1.1. WORK INCLUDED

1.1.1. Section 26 01 00.00 – OPERATING AND MAINTENANCE INSTRUCTIONS.

1.1.2. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.

1.1.3. Section 26 05 04.00 – SUBMITTALS – SHOP DRAWINGS.

1.1.4. Section 26 05 21.00 – WIRES AND CABLES UNDER 2000 V.

1.1.5. Section 26 06 05.16 – LUMINAIRE SCHEDULE.

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. The Engineer's Representative reserves the right not to accept any alternates or substitutions in accordance with the requirements of the Luminaire Schedule. If alternates or substitutions are entertained, then it is the responsibility of the Contractor/Supplier to provide: a comparison table showing the specified and the proposed luminaire performance information, IES files for the proposed luminaires, the 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. An extra review fee, per luminaire submitted, will be charged to the Contractor (with no additional costs to the Project Owner). Reviewed alternates may be rejected, regardless of the payment fee received, when alternates do not meet the project requirements. Invoices must be paid prior to Consultant's review starting or changes in the design documents to incorporate the proposed alternates after their review. The Contractor/Supplier 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 cost to the Owner. Rather than replacing the luminaires, the Engineer's Representative may accept the installation of additional luminaires by the Contractor at no cost to the Owner 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, and voltage.

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.

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.

1.4.8. Where luminaires consist of multiple field assembled components, include manufacturer supplied installation manual detailing the assembly procedure.

1.5. OPERATION AND MAINTENANCE DATA

1.5.1. Provide operation and maintenance data for lighting equipment in accordance with Section 26 01 00.00 – OPERATING AND MAINTENANCE INSTRUCTIONS for incorporation into the manual.

1.5.2. Operation and maintenance instructions shall include documentation related to warranty claim process.

1.6. FIXED PER UNIT COST LUMINAIRES

1.6.1. Listed in the luminaire schedule are a fixed per unit cost for certain luminaire types. Electrical Contractor is responsible for completing 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 carried in the bid for the electrical contract. Provide a breakdown of the total cost, per luminaire type, that is carried under the electrical contract. All luminaires are to be included in the electrical contract including all luminaires identified with fixed unit costs. The Electrical Contractor is to 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.

1.6.2. The fixed per unit cost excludes applicable taxes and includes lamps and distributor markups. Electrical Contractor is responsible to include in the base bid 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.

1.7. CASH ALLOWANCE LUMINAIRES

1.7.1. Listed in the luminaire schedule are ‘cash allowance’ fixtures for certain luminaire types. A complete take-off of the drawings has been done to determine the quantity of each ‘cash allowance’ luminaire type and the total cost has been carried in the Div-0/1 cash allowance value. The total cost for all ‘cash allowance’ luminaires are NOT to be carried in the bid for the electrical contract.

1.7.2. After tender award to the successful Electrical Contractor, the Consultant shall provide the Electrical Contractor the exact manufacturer/model number(s) of all ‘cash allowance’ luminaires and the Electrical Contractor shall be responsible for purchasing the fixtures through the monies from the cash allowance.

1.7.3. Provide a breakdown of the total cost, per luminaire type, that is carried under the base electrical contract. All luminaires are to be included in the base electrical contract excluding all luminaires identified as ‘cash allowance’ luminaires. However the Electrical Contractor is to include ‘cash allowance’ luminaires in Light Fixtures – Materials in the standard progress draw breakdown defined in Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS once the Consultant provides the Electrical Contractor with the exact manufacturer/model number(s).

1.7.4. The cash allowance value carried excludes applicable taxes and includes lamps and distributor markups. Electrical Contractor is responsible to include in the base bid for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all ‘cash allowance’ luminaires. Show the applicable taxes as a separate line item.

1.8. WARRANTY

1.8.1. The manufacturer shall provide a warranty against defects in material and workpersonship, starting at substantial completion. Parts warranty shall be 5 years and labour warranty shall be 1 year.

1.8.2. LED’s, Drivers, Lamps and ballasts showing signs of premature failure shall be replaced at no cost to the owner.

1.8.3. LED Drivers must have a 5 year warranty.

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 are to meet the standards of the Consortium of Energy Efficiency (CEE) guidelines.

2.2.2. Refer to luminaire schedule for project specific details, and lamps required.

2.2.3. Lamps are to be in accordance with the lamp specifications detailed in the Luminaire Schedule and as noted below. Luminaire schedule shall take precedence where differences occur.

2.2.4. All lamps are to be new and are to be from the same manufacturing batch to avoid colour differences. Replace all lamps that exhibit colour shift, or exhibit premature lumen intensity decline, at no cost to the owner.

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 Cree, Osram, Nichia, Toshiba, Lumileds, Bridgelux, or Samsung. Colour temperature shall be as indicated on the luminaire schedule. Lamps are to be binned with no visible colour variance (+/- 100K from specified colour temperature). Rated life for 1 watt white LED shall be 50,000 hours. Lumen output to be 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 cost to the owner. 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 cost of the owner. Additional electrical costs, associated with higher Wattage temporary luminaires, must be reimbursed with interest to the owner by the manufacturer.

.5 In case of failure of an LED luminaire, complete or part thereof, an independent third party testing Laboratory (approved by Smith + Andersen) 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 Smith + Andersen for evaluation and final approval.

.6 Any additional time involved by Smith + Andersen will be billed at our hourly rates to the manufacturer or vendor.

2.3. DRIVERS

2.3.1. All drivers are to be tested and comply with maximum in-rush current limits within NEMA 410 standards. This is to 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 to 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 3 V through 55 V.

.2 Adjustment of LED current from 200 mA to 1.05 A at the 100 percent control input point in increments of 1 mA.

.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 120 V through 277 VAC at 60 Hz.

2.3.9. Driver must 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 0.5 V and 0.65 V 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. 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 10 V Analog Control Protocol, Class 2, capable of sinking 0.6 mA per driver at a low end of 0.3 V. Limit the number of drivers on each 0-10 V control output based on voltage drop and control capacity.

2.3.16. Must meet ESTA E1.3 for RGBW LED drivers

2.3.17. Provide drivers manufactured by Cree, Osram, Nichia, Toshiba, Lumileds, Bridgelux, Samsung, or Eldoleds.

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 luminaire schedule for project specific details.

2.4.4. All ballasts shall be manufactured by Osram/Sylvania, Philips, Advance, GE, Lutron or Magnetek unless indicated otherwise. Ballasts shall operate at voltage and control lamps as noted in the Luminaire Schedule.

2.4.5. Ballasts shall contain no PCB's and audible rating will be class A or better.

2.4.6. Racks are to be provided for remote ballasts.

2.4.7. Ballasts with unacceptable noise levels are to be replaced at no cost to the owner.

2.5. LUMINAIRES

2.5.1. All luminaires are to 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 drawings show luminaires mounted end-to-end, luminaires shall be suitable for continuous, seamless and tandem mounting.

2.5.5. All poles are to come complete with internal vibration dampeners to accommodate wind conditions to avoid damage due to wind-induced vibrations.

2.5.6. 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 structural engineer registered in the local jurisdiction.

2.5.7. 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.

2.5.8. The supply and installation of fixed per unit cost and 'cash allowance' luminaires shall comply with all standards set forth in Electrical Specifications. Electrical Contractor is responsible to include in the base bid for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all fixed per unit cost and 'cash allowance' luminaires.

2.5.9. The following is a list of generic type designation for luminaires. The project specific luminaire schedule is to be referenced for the specific types and designations and the respective specifications.

.1 Designations beginning with the letter 'L' denote LED type.

.2 Designations beginning with the letter 'X' denote exit sign.

3. Execution

3.1. INSTALLATION

3.1.1. It is the responsibility of the contractor to obtain the information related to the luminaire and luminaire trim finishes/colours from the Interior Designer or Architects 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 will 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 according to equipment manufacturer's instructions.

3.1.3. The Electrical Contractor shall be responsible for the supply and installation of all concrete bases for poles and bollards. Unless otherwise shown on the drawings, concrete bases to be ArtForm style or Approved Equal and shall extend a minimum 900 mm above grade in parking lots and a minimum 150 mm above grade in pedestrian walkways.

3.1.4. Poles and bollards are to be installed on independent concrete bases unless indicated otherwise on the drawings or schedules. Coordinate brackets for cameras and supports for banners with pole manufacturer.

3.1.5. Install remote ballasts in racks and wire luminaires to ballasts in conduit. Provide wiring as per manufacturer's recommendations.

3.1.6. Locate luminaires in accordance with the Architect's Drawings. Coordinate exact locations on site. Refer to Architect's drawings for dimensions of coves and valences.

3.1.7. Install in accordance with Manufacturer's Instructions, Local Codes, Electrical Division Drawings and Specifications.

3.1.8. All suspended luminaires shall have cables and support stems vertically aligned.

3.1.9. Suspend luminaires in mechanical rooms after all the mechanical equipment and ductwork are installed. Luminaires are not to be suspended from mechanical pipes, ductwork or other building services.

3.1.10. All luminaires shall be installed underneath other services located within ceiling space. Contractor is responsible for interference drawings to ensure all services in ceiling are coordinated.

3.1.11. 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.

3.1.12. It is the responsibility of the Electrical Contractor to coordinate luminaire trims and mounting system with ceiling finishes. Luminaires delivered on site with the wrong ceiling mounting system shall be replaced without additional costs for the owner. Restocking fees will not be accepted.

3.1.13. For suspended ceiling installations support luminaires from structural slab in accordance with local inspection requirements.

3.1.14. Where luminaires are mounted in tandem, align luminaires mounted in continuous rows to form straight uninterrupted line.

3.1.15. Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.1.16. Ensure light leakage does not occur from openings and trim rings. Contractor is responsible to repair the ceiling at no cost to the Owner if cut-out is too large.

3.1.17. Connect luminaires to lighting circuits.

3.1.18. 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 from the Engineer's Representative.

3.1.19. Modular wiring systems shall be employed only where indicated or with approval of the Engineer's Representative.

3.1.20. Luminaires are not to be used as temporary construction lighting. After being tested to ensure acceptable operation, luminaires will not be used until substantial completion unless permission is received from the owner, architect or Engineer's Representative.

3.1.21. Lamps are to be installed after luminaire is cleaned.

3.1.22. Clean all luminaires, inside and out at time of substantial completion. Replace all scratched or damaged luminaires, lenses, louvers and diffusers at no cost to the owner.

3.1.23. 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 Engineer's Representative/Architect, 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 Owner.

END OF SECTION

27 00 00.00 Index



END OF SECTION

27 00 05.10 General Instructions for Telecommunications Sections

1. General

1.1. OVERVIEW

1.1.1. Read and comply with all sections of this document.

1.1.2. Provide all labour, materials, tools, and equipment required for the complete scope of the Work specified in all sections of the Contract Documents.

1.1.3. Test results for cables that fall under the Pass* and Fail categories shall be submitted to the Owners' Engineering Representative for review and action immediately upon discovery. Submit all Pass cables prior to the IT room being turned over to the owner. See Section 27 08 00.00 – COMMISSIONING FOR TELECOMMUNICATIONS SECTIONS for testing parameters.

1.2. SECTIONS AFFECTED

1.2.1. These instructions apply to and form a part of all Telecommunications Sections.

1.3. INTENT

1.3.1. The Specifications are an integral part of the accompanying Drawings. Any item or subject omitted from one or the other, but which is either mentioned or reasonably implied, shall be considered as properly and sufficiently specified.

1.3.2. Be completely responsible for the acceptable condition and operation of all systems, equipment, and components forming part of the installation or directly associated with it. Promptly replace defective material, equipment, and repair related damages. The replacement of equipment and repair to damages shall be coordinated with other trades completed in a timely fashion so as not to affect the complete construction of the Telecommunications Systems and/or work by others.

1.4. WORK INCLUDED

1.4.1. Provide a new Telecommunications Structured Cabling system for the area included in the scope of this Contract. The Structured Cabling Systems shall be as follows:

.1 Horizontal Structured Cabling System consisting of 4-pair Copper Cabling for data applications.

1.4.2. All horizontal cabling shall be serviced from the nearest logical Telecommunications Room, either existing or new as shown on floor plans.

1.4.3. The Telecommunications Structured Cabling system is based on a physical star wiring topology (unless otherwise specified) 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.

1.4.4. Provide CMP (FT6) rated components of the Telecommunications Cabling System that is to be located within mechanical spaces deemed a Return Air Plenum. CMR (FT4) rated components may be used in mechanical spaces upon approval by all Authorities Having Jurisdiction (AHJ) and/or the Telecommunications Engineer's Representative. 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.

1.4.5. While every attempt has been made to ensure all information is correct at the time of publication, the products specified are available and that any part numbers identified are correct, it is the responsibility of the Telecommunications Contractor to verify all part numbers and to report any errors and/or omissions in the Drawings and/or Specification during the procurement process.

1.4.6. Dimensions shown on Drawings are approximate. Verify dimensions by reference to Shop Drawings and field measurements.

1.4.7. Quantities or lengths indicated in any of the Contract Documents are approximate only and shall not be held to gauge or limit the Work.

1.4.8. Include 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.

1.5. BIDDER INQUIRIES

1.5.1. Bidders who find discrepancies or omissions in this RFQ, or who have any doubt as to the technical meaning or intent of any part of this RFQ, shall direct their questions or other inquiries in writing to the Telecommunication's Engineer's Representative as defined in Section 27 00 05.20 – DEFINITIONS AND ABBREVIATIONS

1.5.2. In fairness to all bidders, all questions will be answered and distributed to all. Oral questions will not be answered. No questions will be answered within 48 hours of the closing date / hour of the bid. Refer to Division 0 for question period close time and date.

1.6. TENDER FORMS AND SUBMISSION OF TENDERS

1.6.1. Submit all information called for on the Telecommunications Tender and Supplementary Tender Forms. Tenders not completed in full may, at the discretion of the Owner, be rejected.

1.6.2. Show separate, identified, alternate and unit prices for optional components or items called for as additions to or deductions from the Tender amount.

1.6.3. The Owner reserves the right to accept or reject any substitution without question.

1.6.4. Include incidental fees and other fees for items required to successfully install the Structured Cabling Solution that may or may not be indicated in this document. Meet all requirements of this document and all telecommunications (and related) standards, municipal, local, Provincial and Federal building, safety, fire and electrical codes.

1.7. HOLDBACK

1.7.1. The value for testing and documentation (cable test results and as-builts), for payment purposes, shall be set at 10% of the base contract or $5,000; which ever is greater. This amount will be withheld from the Telecommunications Contractor until testing and correction of deficiencies is 100% complete.

1.8. SCHEDULE

1.8.1. By submitting a response to this document and associated Drawings, the Telecommunications Contractor agrees to meet and adhere to all project milestones as indicated in the project schedule(s).

1.8.2. Acknowledge that project schedule(s) are subject to change. Verify all project milestones with the Telecommunications Engineer's Representative and/or General Contractor.

1.9. LABOUR

1.9.1. Comply with all job-site requirements for the duration of the project.

1.9.2. Do not assign or sub-contract any Work without the prior written consent of the Telecommunications Engineer's Representative. In the event of sub-contractor approval, submit a complete list of sub-contractors during the procurement process.

1.9.3. Use only workers who are fully trained, qualified, and experienced on the installation, termination, and testing of the Structured Cabling Solution.

1.9.4. Third party certification will not be permitted unless the certifying contractor performs the termination and testing for all cabling. If third party certification is necessary, the Telecommunications Contractor shall obtain the consent of the Telecommunications Engineer's Representative prior to submitting a bid response.

1.9.5. Make any changes or alterations required by an authorized inspector of the authority having jurisdiction.

1.9.6. Obtain consent from the Telecommunications Engineer's Representative before changing the Project Manager and/or Site Supervisor during the Project.

1.10. ACCESS AND PROTECTION

1.10.1. Access to the Site shall be limited to location and time of day. Refer to Section 27 00 05.70 – PROJECT SPECIFIC REQUIREMENTS and conform to requirements.

1.10.2. Refer to the security and protection requirements in the General Conditions and conform to all requirements.

1.11. DRAWINGS, CHANGES AND INSTALLATION

1.11.1. The Drawings are intended to show the general character and scope of the Work and not the exact details of the Work. Complete the Work with all accessories required for a complete and operative installation.

1.11.2. 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 Telecommunications Engineer's Representative reserves the right to make reasonable changes required to accommodate conditions arising during the progress of the Work, at no extra cost to the Owner.

1.11.3. Certain details indicated on the Drawings are general in nature and specific labelled detail references to each occurrence of use is not indicated, however, such details shall be applicable to every occurrence on the Drawings.

1.11.4. The location and size of existing services shown on the Drawings are based on the best available information. Verify the actual location of existing services in the field before Work is commenced.

1.11.5. Make changes and modifications necessary to ensure co-ordination and to avoid interference and/or conflicts with other trades, or to accommodate existing conditions, at no extra cost to the Owner.

1.11.6. 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.

1.11.7. Where equipment is shown to be 'roughed in only', obtain accurate information from the Telecommunications Engineer’s Representative before proceeding with the Work.

1.11.8. Location of outlets, luminaires, diffusers, grilles, registers, thermostats, sprinklers, and all other equipment shown on Drawings (if shown) is diagrammatic.

1.11.9. Remedy any Work not installed in correct location (at the sole discretion of the Telecommunications Engineer’s Representative). The Telecommunications Contractor is responsible to mark-out their Work and fully co-ordinate with all other trades. Review the Work with Telecommunications Engineer’s Representative prior to rough in.

1.12. APPROVED EQUAL

1.12.1. Wherever the term "approved equal", "approved equivalent", or another variation is used herein, it is to be understood that reference to the specified trade name, brand name, manufacturer's name, model number, and catalog number has been made solely to indicate the minimum standard of quality required in material, workmanship, and service. Any proposed alternate shall be submitted for review and acceptance before procurement and installation. The review and acceptance shall be at the sole discretion of the Owner and the Telecommunications Engineer's Representatives.

1.13. CONFLICTING REQUIREMENTS

1.13.1. In the case of conflict or discrepancy in the requirements indicated in the contract documents the more stringent, onerous, and/or costly requirement shall apply.

1.14. EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

1.14.1. Materials and equipment provided under this Division shall be new and free from defects.

1.14.2. All equipment and material for which there is a listing service shall bear a ULC and/or CSA label.

1.14.3. Equipment shall meet all applicable FCC/CRTC Regulations.

1.14.4. Materials shall have a flame spread in accordance with local Authorities Having Jurisdiction, and in accordance with the Specifications of this project.

1.15. DOCUMENT FORMAT

1.15.1. 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 provided for the project. The third part ‘Execution’ details the requirements for the installation of the specified products. Reference sections 1 and 3 for the relevant General information and Execution requirements of products that are listed in section 2.

1.16. STATEMENT OF PRICES

1.16.1. Submit a statement of their estimated prices for the various portions of the Work including both labour and materials to form a basis of progress payments. The total price of all portions of the Work shall equal the total price of the Work covered under the Telecommunications Division.

1.17. VALUATION OF CHANGES

1.17.1. Further to contract requirements, the method to be used in determining the value of a change to the Work, by either Change Order or Change Directive, shall be:

.1 Estimate and acceptance in a lump sum, unless the Telecommunications Engineer's Representative otherwise determines that the method shall be unit prices set out in the Contract.

1.17.2. Provide the Telecommunications Engineer's Representative with a detailed cost analysis of the contemplated change indicating:

.1 Quantity of each material.

.2 Unit cost of each material.

.3 Time involved.

.4 Sub-trade quotations including a complete analysis of costs.

.5 Mark-ups, if applicable.

.6 Value of GST or HST, as applicable.

.7 Proposed change in Contract Time.

1.17.3. The detailed cost breakdown is to list material and labour separately for each item on the proposed change. The breakdown for contemplated change is to follow the format of the attached document.

1.17.4. The following shall not be included in the cost of the Work but are covered by the allowance (mark-ups) for overhead and profit:

.1 The Contractor's head office and site office expenses, including stationary, postage and other office supplies.

.2 The costs of the Telecommunications Contractor's Project Manager, clerical and administrative personnel, and executive personnel.

.3 Use of temporary offices, sheds, small tools, etc., including the cost of telephone, light, power, water and heat used therein,

.4 Transportation and overnight room expenses for out of town labour, if local labour is unavailable.

.5 Insurance premiums.

.6 Licenses and permits, except when these are special for a particular item of Work.

.7 Printing charges for Proposed Changes, Change Orders and Drawings for the Contractor's and Subcontractors use in the Work. Telecommunications Engineer's Representative will provide one PDF copy of change notice documentation and in the event of re-issue of full size Drawings will provide one print.

.8 The cost of as-built drawings and Shop Drawings.

.9 The cost of cleanup and disposal of waste material.

.10 Parking.

1.17.5. The Contractor shall not be entitled to any additional compensation arising out of changes to the Work other than the amounts determined and agreed to under CCDC 2-[latest version] GC 6.2.

1.17.6. Inform the Surety Company or Companies who have issued any bonds for this Contract, and any Insurers who have insured any part of the Work or operations or who have an interest in this Contract, of all changes in the Contract. Pay all costs of any changes in bonds or insurances required to maintain bonds or insurances in conformance with the requirements of the Contract Documents. Provide Owner immediately with any revised bonds or insurances.

1.17.7. Charge special equipment rental rates at cost. Submit the invoice for special equipment rental with the cost of the Work.

1.17.8. Permitted Mark-Ups

.1 Maximum net overhead and profit mark-ups permitted for extra Work under Change Order or Change Directive:

| Cost of Extra Work, not including GST or HST, as applicable | Contractor's Mark-Up on Work of Own Forces (%) | Contractor's Mark-Up on Subcontracted Work (%) |
|---|---|---|
| $0 to $5,000 | 10 | 7 |
| >$5,000 to $10,000 | 10 | 7 |
| >$10,000 to $50,000 | 7 | 5 |
| >$50,000 | 5 | 4 |

.2 Maximum net overhead and profit mark-ups by Subcontractors permitted for extra Work:

| Cost of Extra Work, not including GST or HST, as applicable | Contractor's Mark-Up on Work of Own Forces (%) | Contractor's Mark-Up on Subcontracted Work (%) |
|---|---|---|
| $0 to $5,000 | 10 | 7 |
| >$5,000 to $10,000 | 10 | 7 |
| >$10,000 to $50,000 | 7 | 5 |
| >$50,000 | 5 | 4 |

.3 Where a proposed change order includes both credits and extras, overhead and profit mark-ups apply to the net extra or credits, if any, of the entire change.

1.17.9. All changes, change notices, revisions to contract, site instructions, change directives or any additional costs or deletes to the stipulated lump sum contract price are subject to review and scrutiny by a qualified third party or individual.

1.17.10. Labour Rate:

.1 For the duration of the contract, extra Work hourly labour units are to be based on the latest edition of the National Electrical Contractors Association (NECA) labour unit's column 1 (one). No additional factors will be accepted.

.2 The hourly labour rate for all changes will be based on a Journeyperson rate as listed on the Supplementary Bid Form. The Owner and/or Telecommunications Engineer's Representative reserve the right to renegotiate the labour rate. The hourly labour rate will be exclusive of overhead and profit. The labour rate will be inclusive of all labour burden charges including: payroll and administrative burdens, all government payroll burdens, variable labour factors and union or association funds.

.3 The following labour burdens are not part of the hourly labour cost and are covered under overhead and mark-up or under the NECA labour unit rates: all supervision, hand tools, warranties, storage, rentals, parking, clean-up, additional bonding, as-built

drawings, material sorting/handling/hoisting, project financing, coffee break/rest periods, safety training including safety briefings, WHMIS and the health and safety committee, non-productivity time and site office and consumables.

.4 Submit a detailed labour cost breakdown showing a breakdown of all adders to the base wage rate comprising the proposed hourly rate. The Owner and the Telecommunications Engineer's Representative reserve the right to negotiate the hourly labour rate with the Contractor.

# PROPOSED CHANGE ORDER

| | |
|---|---|
| Company Name: | CCN # |
| Address: | Date: |
| City, Prov.: | Project Name: |
| Postal Code: | Project Number: |
| | Quote Number: |
| Telephone: | Change Order #: |
| Fax: | |
| E-Mail address: | |
| Owner Address: | |

**Work Description**

We reserve the right to correct this quote for errors and omissions.
This quote covers direct costs only.
This price is good for acceptance within 30 days from the date of receipt.

**Itemized Breakdown**

| Description | Qty. | Net Price U | Total Mat($) | Labor U | Total Hours |
|---|---|---|---|---|---|
| 4-Pair Category Cable | | $X.XX C | | $X.XX C | |
| Termination Module | | $X.XX C | | $X.XX C | |
| Patch Cord | | $X.XX C | | $X.XX C | |
| Modular Patch Panel | | $X.XX C | | $X.XX C | |
| Labelling | | $X.XX C | | $X.XX C | |
| Testing | | $X.XX C | | $X.XX C | |
| **TOTALS** | | | | | |

**Summary**

| Description | | Total Hours |
|---|---|---|
| General Materials | | $Y.YY |
| | | _____ |
| **Material Total** | | |
| JOURNEYPERSON | (xx Hrs. @ $xx.00) | |
| | | _____ |
| Subtotal | | |
| **MARK-UP** | | |
| Overhead/Mark-up | (@ 5.000 %) | _____ |
| Profit | (@ 5.000%) | |
| Total Mark-up | | _____ |
| **Final Amount (TNIP)** | | |

2. Products

2.1. SYSTEM PERFORMANCE

2.1.1. 4-Pair Horizontal Copper Cabling – Data System

.1 All components of the horizontal data channel shall meet the minimum performance characteristics of: 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. Acceptable manufacturers for the complete 4-pair horizontal voice and data systems: Manufacturer / Contractor Certification

.1 Belden Incorporated / CSV – Certified Systems Vendor

.2 Panduit Corporation / PCI – Panduit Certified Installer

.3 CommScope Incorporated (Systimax) / CPP – CommScope Partner Pro

3. Execution

3.1. TERMINATION REQUIREMENTS

3.1.1. UTP Cables

.1 Terminate cabling using EIA/TIA 568A configuration, unless noted otherwise.

3.2. SITE EXAMINATION

3.2.1. Prior to submitting their tender response, perform a site survey (when available) to familiarise their workers with the site and all conditions of the site affected by the proposed Work. No claims for extra payment will be considered because of failure to fulfil this condition.

END OF SECTION

27 00 05.20 Definitions and Abbreviations

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. |
| Telecommunications Contractor | - | The successful bidder to this Specification responsible for the supply and installation of the Structured Cabling Solution as detailed in this document and associated Drawings. |
| 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 | - | Complete end to end connection including patch cords, cable and termination device(s). |
| Cut Over | - | The live date(s) when the Owner will occupy the space as indicated by date and/or phasing. |
| Drawings | - | Details, diagrams, layouts, schedules, and other information in a design drawing package accompanying this specification. |
| 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. |
| Owner | - | Person or company that will own the system and components. |
| Project | - | Supply and installation of a complete Structured Cabling Solution to support Voice, Data and/or Video applications as described in this document. |
| Provide | - | Supply, install, test, configure, and document. |
| Shop Drawings | - | Contractor provided construction drawings to facilitate compliance with the plans and specifications. |
| Telecommunications Engineer's Representative | - | Joshua Blizzard<br>Smith + Andersen<br>1100 - 100 Sheppard Avenue East, Toronto, ON - M2N 6N5 |
| Workstation | - | Systems Furniture Workstation, Office, Meeting Room, Boardroom, Classroom, etc.<br>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 | - | European Committee for Electrotechnical Standardization |
| 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 |
| CRTC | - | Canadian Radio-television Telecommunications Commission |
| 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 |
| DID | - | Direct Inward Dialing |
| DSL | - | Digital Subscriber Line |
| EF | - | Entrance Facility |
| EIA | - | Electronics Industry Alliance |
| ELFEXT | - | Equal Level Far-End Crosstalk |
| e-mail | - | Electronic Mail |
| EMI | - | Electromagnetic Interference |
| EMI/RFI | - | Electromagnetic Interference / Radio Frequency Interference |
| ER | - | Equipment Room |
| ESD | - | Electrostatic Discharge |
| ETL | - | Edison Testing Laboratories |
| e/w | - | Equipped With |
| FC | - | Fibre Connector |
| FCC | - | Federal Communications Commission |
| FDDI | - | Fibre Distributed Data Interface |
| FEP | - | Fluorinated Ethylene Propylene |
| FEXT | - | Far-End Crosstalk |
| FOTP | - | Fibre Optic Test Procedure |
| ft | - | Foot / Feet |
| ft2 | - | Square Foot / Feet |
| FTTD | - | Fibre To The Desk |
| FT 1 / FT 3 | - | Fractional T 1 / Fractional T 3 |
| G | - | Giga |
| Gb | - | Gigabit |
| GB | - | Gigabyte |
| Gb/s | - | Gigabit per Second |

| | | |
|---|---|---|
| GC | - | General Contractor |
| GHz | - | Gigahertz |
| GWB | - | Gypsum Wall Board |
| HC | | Horizontal Cross-connect |
| Hz | - | Hertz |
| I | - | Current |
| IC | - | Intermediate Closet |
| IC | - | Intermediate Cross-connect |
| ID | - | Identification |
| ID | - | Inside Diameter |
| IDC | - | Insulation Displacement Connection |
| IDC | - | Insulation Displacement Connector |
| IDC | - | Insulation Displacement Contact |
| IDF | - | Intermediate Distribution Frame |
| IEEE® | - | Institute of Electrical and Electronics Engineers, Inc. ® |
| IG | - | Isolated Ground |
| in | - | Inch |
| in2 | - | Square Inch |
| I/O | - | Input / Output (Device) |
| ICEA | - | Insulated Cable Engineers Association |
| IEC | - | International Electrotechnical Commission |
| 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 |
| LEN | - | Local Exchange Node |
| LSZH | - | Low Smoke Zero Halogen |
| m | - | Metre |
| m2 | - | Square Metre |
| mA | - | Milliampere |
| MAC | - | Move, Add, or Change |
| MAN | - | Metropolitan Area Network |
| Mb | - | Megabit |
| MB | - | Megabyte |
| Mb/s | - | Megabit per Second |
| MB/s | - | Megabyte per Second |
| MC | - | Main Cross-connect |
| MDF | - | Main Distribution Frame |
| MGB | - | Main Grounding Busbar |
| MHz | - | Megahertz |
| mi | - | Mile |
| MIMS | - | Mineral Insulated Metal Sheathed |
| min | - | Minute |
| mm | - | Millimetre |

| | | |
|---|---|---|
| MM | - | Multimode |
| MMF | - | Multimode Fibre |
| 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 |
| RFQ | | Request for Quote |
| 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 |
| TGB | - | Telecommunications Grounding Busbar |
| TGR | - | Telecommunications Grounding Rod |
| TIA | - | Telecommunications Industry Association |
| TMGB | - | Telecommunications Main Grounding Busbar |
| TN | - | Telecommunications Node |
| TP | - | Twisted Pair |
| TR | - | Telecommunications Room |
| TS | - | Technical Standard |
| TSB | - | Telecommunications Systems Bulletin (formerly Technical Systems Bulletin) |
| TTY | - | Teletypewriter / Text Telephone |
| TV | - | Television |
| TX | - | Transmit |
| TX | - | Transmitter |
| 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 05.30 Codes, Standards and Regulations

1. General

1.1.1. Code, Standard and Regulation Compliances

.1 The Telecommunications 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 Telecommunications 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.

.5 Table 1: Applicable Codes, Standards and Regulations

| STANDARD | TITLE |
|---|---|
| ANSI/ICEA | |
| S-80-576 | Communication Cables. |
| ANSI/TIA/EIA | |
| 568.0 | Generic Telecommunications Cabling for Customer Premises, latest version. |
| 568.1 | Commercial Building Telecommunications Infrastructure Standard, latest version. |
| 568.2 | Balanced Twisted Pair Telecommunications Cabling and Component Standard, latest version. |
| 569 | Commercial Building Standard for Telecommunications Pathways and Spaces including all addenda, latest version |
| 606 | Administration Standard for Telecommunications Infrastructure, latest version. |
| 607 | Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, latest version. |
| CSA | |
| C22.1 | Canadian Electrical Code Part I: Safety Standards for Electrical Installations, latest version. |
| C22.2 No. 41 | Grounding & Bonding Equipment |
| C22.2 No. 182.4-M90 | Plugs, Receptacles, and Connectors for Communication Systems, latest version. |

| | |
|---|---|
| C22.2 No. 214-17 | Communications Cables. |
| CAN/CSA-C22.2 No. 0-10 | General Requirements, Canadian Electrical Code, Part II (latest version) |
| OTHER | |
| CAN/ULC-S115 | Standard Method of Fire Tests of Firestop Systems, latest version. |
| CAN/ULC S101 | Standard Method of Fire Endurance Tests of Building Construction and Materials, latest version. |
| CAN/ULC S102 | Standard Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies, latest version. |
| CENELEC EN 50173 | Information Technology – Generic Cabling Systems Part 1: General Requirements, latest version |
| CLC | Canada Labour Code, Part II Occupational Health and Safety, and Provincial and Local Health and Safety regulations |
| IEC 60603-7 | Connectors for electronic equipment - Part 7: Detail specification for 8-way, unshielded, free and fixed connectors, latest version. |
| ISO/IEC IS 11801-1 | Information Technology - Generic Cabling for Customer Premises – Part 1: General Requirements, latest version. |
| NEMA WC 63.1 | Performance Standard for Twisted Pair Premise Voice and Data Communications Cable, latest version. |
| RoHS | Restriction of Hazardous Substances Directive 2011/65/EU, latest version |

.6 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 Owner.

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. Remove these items from premises when no longer required.

1.1.3. Metric Conversions

.1 Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, equipment, material, and site services in both new and existing installations.

1.1.4. Cutting, Patching and Repairing

.1 Perform all cutting, patching, repairing, and making good related to the Telecommunications Cabling Work including any penetrations through walls or floors.

.2 Allow for all costs associated with cutting, patching, repair, and making good related to the Telecommunications Work including any penetrations through walls or floors.

.3 Paint all visible Telecommunications conduit to match existing.

.4 Coordinate the colour and location of all conduits, devices, and their housing with architect and architectural drawings on-site before installation.

2. Products

2.1. NOT USED

3. Execution

3.1. CODE, STANDARD AND REGULATION COMPLIANCES

3.1.1. Install and terminate all cables and components in accordance with CSA, the latest edition of ANSI/EIA/TIA-568 and its Amendments as well as UL/ULC Guidelines. Maintain 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.

3.1.2. Comb and bundle all cables in a neat and organised manner. The Telecommunications Engineer’s Representative will determine neatness of the installation. Cables that have not been properly combed and dressed shall be re-dressed at the Telecommunications Contractor’s expense. Coordinate with the Telecommunications Engineer’s Representative prior to re-dressing cables.

3.1.3. The maximum horizontal run length for 4-pair cabling shall not exceed 90-metres. If the 90-metre constraint cannot be met, notify the Telecommunications Engineer’s Representative of any cables that exceed 90-metres, prior to installation.

END OF SECTION

27 00 05.50 Contract Documents

1. General

1.1. CONTRACT DOCUMENTS

1.1.1. Read and complete the Telecommunications Tender forms.

1.1.2. All Contract Documents, including all General Conditions, Division 1 Specification Sections (if present) and Instructions to Bidders apply to this section and all other Specification sections.

1.1.3. Read and comply with all requirements as stated in Divisions 0 and 1. In the event of a conflict between Divisions 0 or Division 1 sections and information contained in Sections 27 00 05.10 - GENERAL INSTRUCTIONS FOR TELECOMMUNICATIONS SECTIONS, 27 00 05.60 – ADMINISTRATIVE REQUIREMENTS, and 27 00 05.70 – PROJECT SPECIFIC REQUIREMENTS of this document, the more stringent, onerous, and/or costly requirement shall apply.

1.2. WORK INCLUDED

1.2.1. Drawings List

.1 Refer to the drawing list in the Telecommunications Drawings for a list of drawings that shall be used for preparation of bids and construction.

2. Products

2.1. NOT USED

3. Execution

3.1. COORDINATION

3.1.1. Carefully examine Work and Drawings of all related trades and thoroughly plan the Work to avoid conflict or interference with other services. Report defects that would adversely affect Work. Do not commence installation until defects have been corrected. Beginning the Work constitutes acceptance of conditions as satisfactory.

3.1.2. Co-ordinate the Work of this Contract such that items will properly interface with the Work of other trades. Prepare installation drawings of critical locations and submit to the Telecommunications Engineer's Representative for review.

END OF SECTION

27 00 05.60 Administrative Requirements

1. General

1.1. PROJECT CLOSEOUT SUBMITTALS

1.1.1. Project closeout submittals shall include:

.1 Table of contents

.2 As-built drawings

.3 Cable Test Results

.4 Warranty Letters

.5 Manufacturer Certification

1.2. WORK INCLUDED

1.2.1. Closeout Submittal – As-built Drawings

.1 Prepare drawing(s) to clearly mark all changes and deviations during the construction process, including 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. Include all additional cables installed during the project in the as-built drawings.

.2 The Telecommunications Engineer's Representative has 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, submit to the Telecommunications Engineer's Representative a soft copy of as-built drawings indicating all such changes and deviations for review within five (5) business days of the completion of the project.

.3 Request (in writing) from the Telecommunications Engineer's Representative a soft copy of the Drawings for use by the Telecommunications Contractor in preparation for as-built Drawings. Update the soft copy drawing(s) with correct as-built information (i.e. cable numbers, outlet locations, rack/backboard elevations, etc.) in digital format using the most current version of the Drawings native format (e.g.: AutoCAD or Revit).

.4 All changes to drawing(s) shall follow conventional Engineering Draft Standards. All outlet locations shall be identified with proper designation.

.5 If the Telecommunications Contractor cannot comply with this requirement, Smith + Andersen will transfer all hand drawn as-builts to the Drawing's native format (AutoCAD or Revit) at a cost to the Telecommunications Contractor. The cost for this service shall be based on per diem rates at time of completion.

.6 Print / plot two sets of as-built Drawings at no extra cost. Final as-built print(s)/plot(s) must not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.) and shall be delivered to the Owner.

.7 The project will remain incomplete and a holdback will be retained until satisfactory as-built drawing(s) are provided.

1.2.2. Closeout Submittal – Cable Test Results

.1 Produce 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.

.2 An authorized person for the Telecommunications Contractor must sign the entire report. Supply one (1) soft copy in the tester's native format, along with the appropriate software to read the test results.

.3 The project will remain incomplete and a holdback will be retained until satisfactory cable test results are provided.

.4 Provide testing and commissioning documentation for all items and their related components to the Telecommunications Engineer's Representative prior to the completion of the project or at the Telecommunications Engineer's Representatives request. Include maintenance manuals and operating instructions for Owner's staff use.

1.2.3. Closeout Submittal – Warranty

.1 Provide a minimum of a 2-year unconditional parts and labour Warranty for all equipment and labour provisioned under this contract, from the date of substantial performance of the contract, for each Telecommunications cabling system.

.2 Response time for Warranty items shall be 24 hours. Repair deficient Cabling Solution components outside regular working hours. Bidders shall include a statement of Warranty terms and conditions with their contract documents.

1.2.4. Closeout Submittal – Manufacturer Certification

.1 Arrange for a minimum of 25-year Manufacturer's Warranty and System Performance Guarantee, from the date of substantial performance of the contract, for each Telecommunications cabling system.

.2 Provide a manufacturer Warranty that the Structured Cabling Solution is installed and fully operating in accordance with this and the manufacturer Specifications.

.3 Upon request and at no additional cost to the Owner the Telecommunications Contractor must provide a manufacturer's technical representative to conduct an on-site visit to ensure complete technical compliance.

.4 All documentation including the certificate must be in English and French, and shall be submitted to the Telecommunications Engineer's Representative for signed acceptance prior to their production.

1.2.5. Project Submittal – 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 Prepare specifically for this project each Shop Drawing for non-catalogue items. Clearly mark Shop Drawings and brochures for catalogue items to show what is being supplied.

.3 Stamp and sign each Shop Drawing or catalogue sheet shall to indicate the drawing has been checked by the Telecommunications Contractor for conformance with all requirements of the Drawings and Specifications, that they have co-ordinated this equipment with other equipment to which it is attached and/or connected and that they have 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 co-ordination is complete before submitting Shop Drawings for review.

.4 Installation of any equipment shall not start until after final review of Shop Drawings by the Engineer's Representative has been obtained.

.5 When requested, supplement Shop Drawings by data explaining the theory of operation. The Engineer's Representative may also request that this information be added to the maintenance and operating manual.

.6 Provide space for Shop Drawing review stamps for the Telecommunications Contractor and Telecommunications Engineer's Representative. 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 Telecommunications Contractor.

1.2.6. Project Submittal – Permits, License Reviews and Fees

.1 Where materials are specified 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 Drawings and Specifications may be used for this purpose. Prepare any additional information, details and Drawings these authorities may require.

1.2.7. Project Submittal – Substitutions and Alternate Products

.1 This document specifies the use of a complete end-to-end Structured Cabling Solution as manufactured, warranted and certified by a single manufacturer. Alternate materials (from the overall cabling solution) will not be accepted unless specifically noted.

.2 Where supply of the materials may compromise the schedule, submit a request to use alternate product to the Telecommunications Engineer's Representative. Depending on the circumstance, the Telecommunications Engineer's Representative may provide written authorisation to substitute the Product. Obtain written authorization before providing alternates.

.3 Where a separate price is requested in this document, prepare quotation(s) to install/provide products and/or systems as outlined. Submit the separate price quotation with the bid response. Instructions and products requested under separate price sections shall not be considered substitutions or alternate products.

.4 The Telecommunications Engineer's Representative's decision regarding the acceptance or rejection of the proposed substitution is 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.

.5 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, and

.7 Reason(s) for the request.

.6 Substitution submissions do not relieve the Telecommunications Contractor from the obligation of preparing and submitting a contract documents 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 as a separate or alternate price format.

1.2.8. Project Submittal – Scheduling

.1 Within one week of award of the contract, submit a formal project schedule to the Telecommunications Engineer's Representative showing start and finish dates of major tasks as denoted by system such as: demolition, backbone cabling, horizontal cabling, rack and cabinet installation, material order and delivery to site and testing.

.2 Submit updated schedules as periodically requested by Telecommunications Engineer's Representative.

1.2.9. Project Submittal – Review and Testing Requirements

.1 Develop and submit a test plan indicating the process and types of tests to be performed. The plan must indicate the testing process for each cable.

.2 The Telecommunications Engineer's Representative must approve the testing procedure prior to testing commencing and may request to be present during the initial testing.

.3 Invite the Telecommunications Engineer's Representative to witness field testing a minimum of five (5) business days before testing commences.

.4 Upon completion of the testing the Telecommunications Engineer's Representative may request a random test of up to 10% of the links. The Telecommunications Contractor 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. A penalty of $50.00 shall be deducted from the Contract amount for each cable that fails to pass the random test. If more than 2% of the sample results differ in terms of the pass/fail determination, repeat 100% testing under the supervision of the Telecommunications Engineer's Representative. The cost of the labour required for the testing as well as the cost for the supervision by the part of Telecommunications Engineer's Representative shall be borne by the Telecommunications Contractor.

1.2.10. Keep the site and surrounding area clean, safe and free from debris at all times. Remove all debris from the site on a daily basis. The costs for cleaning are the responsibility of the Telecommunications Contractor.

1.2.11. Upon completion of the Work and before acceptance and final payment will be made, clean and remove 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.

1.2.12. Before acceptance by the Telecommunications Engineer's Representative, all the equipment and cabling must be cleaned and tested.

2. Products

2.1. NOT USED.

3. Execution

3.1. NOT USED.

END OF SECTION

27 00 05.70 Project Specific Requirements

1. General

1.1. WORK INCLUDED

1.1.1. Cable Installation

.1 The Telecommunications Contractor may assume at their own risk that the entire cable installation will be done during regular hours, except:

.1 Where noted otherwise in this specification;

.2 As outlined in the project front end documents.

1.1.2. Floor/Ceiling Tiles

.1 Remove and re-install all floor/ceiling tiles in areas affected by the Work. This shall be done on a daily basis for all areas that are occupied during the construction period. Otherwise, remove and re-install the tiles after the Work is complete.

.2 Any damage to ceiling tiles during the installation of any Work described in this document is the responsibility of the Telecommunications Contractor. Damages include chipping, breaking and/or soiling. Final decisions on the trade responsible for any damage to ceiling tiles shall be made by the Owner and/or the Telecommunications Engineer's Representative.

.3 The Telecommunications Contractor shall be responsible for storage and protection of floor/ceiling tiles when they have been removed from the floor/ceiling grid.

1.1.3. Cut Over Planning and Management

.1 Include for a total of 16 hours cut over support, to be used at the discretion of the Owner/Telecommunications Engineer's Representative. The technician shall be available to provide services to the Owner as required. This may involve additional testing or Move, Add, Change (MAC) activity. Any additional materials used shall be addressed separately.

.2 Schedule installers such that the cut over schedule is maintained. Any shift work or overtime premiums that are required to complete the project on schedule shall be included in the Telecommunications Contractor's contract Price.

1.1.4. Safety of Persons and Property

.1 Comply with all laws, ordinances, rules, regulations, and policies of the Owner 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 Maintain 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.

.5 No open flames/smoking shall be permitted without prior written approval of the Owner.

.6 Set up and remove all signage and safety measures to ensure that other trades and non-trade personnel are safe from work of the Telecommunications Contractor.

1.1.5. Access to Site

.1 Coordinate site access with the Project Manager and/or Owner as determined during the initial project meeting.

1.1.6. Identification

.1 All Telecommunications Contractor personnel shall be clearly identified by either uniform or company ID. The Telecommunications Contractor may also be required to wear Owner provided ID for required card access locations or identification. All Owner ID(s) must be returned daily or at the end of the project as determined by the Owner.

1.1.7. Emergency Facilities

.1 The Telecommunications Contractor shall maintain 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.

1.1.8. Product Delivery Requirements

.1 Be responsible for complete delivery, handling, and installation of all materials used in the performance of the Work.

.2 Arrange for the delivery of Owner furnished equipment/materials related to the Specifications or Drawings and related items, including unloading of supplier's truck, elevator scheduling, storage, and placement on as indicated on Contract Drawings.

1.1.9. Product and Tools Storage Requirements

.1 Be responsible for storage and handling of all materials used in the performance of the Work.

.2 Job boxes may be allowed to be stored on the site during construction. The tools and the job box shall be the responsibility of the Telecommunications Contractor. The Owner and their representative shall be in no way responsible or liable for any tools of the Telecommunications Contractor.

1.1.10. Confined Spaces

.1 Where Work is performed in a confined space, comply with all code related and Owner specific safety requirements.

1.1.11. Coordination with Occupants

.1 Be responsible for co-ordinating all Work with the Owner/tenant of the floor space for their daily work.

1.1.12. Project Meetings

.1 Attend site meetings when requested by the Telecommunications Engineer's Representative and/or the Project Manager. Regular meetings may occur once per week at the Telecommunications Engineer's Representative's and/or the Project Manager's discretion.

.2 Attend scheduled 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.

1.1.13. Progress Reports

.1 Prepare and issue a status report at the scheduled project meeting including status of: progress, project completion for phases, material ordering and delays.

2. Products

2.1. NOT USED

3. Execution

3.1. PRODUCT DELIVERY REQUIREMENTS

3.1.1. Unload 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 Telecommunications Contractor shall be 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 liability of the Telecommunications 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 00 06.00 Fire Stopping and Water Proofing

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 in accordance with Fire Code and Building Code requirements.

.3 Establish/re-establish the integrity of all fire-rated structures and assemblies that they have created or disturbed, or that were created by others for use by the Telecommunications Contractor.

.4 Provide 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 Provide 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 Standards.

.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 Fire Code, Building Code, and Building Standards.

.11 Where moisture seals are required for floor penetrations in Operating Rooms, Morgues, and Laboratories in Hospitals, Universities and Schools, the Fire Stop Materials selected shall be compatible with Formalin.

.12 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. Water Proofing

.1 Seal all foundation penetrating conduits and service entrance conduits and sleeves to eliminate the intrusion of moisture and gases into the building. This requirement also includes spare conduits.

.2 Seal or reseal all service entrance conduits through building upon cable placement. Plug spare conduits with expandable plugs.

1.1.3. Quality Assurance

.1 Provide fire stopping systems that comply with the following requirements following:

.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 Codes.

.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.

1.1.4. 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 Seal openings for cable trays using re-enterable fire stopping pillows.

1.1.5. 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 Corporation (or approved equivalent) are acceptable.

2.2.2. Obtain fire stop systems for each type of penetration and construction condition indicated only from a single 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. 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 document.

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. WATER PROOFING

3.2.1. Conduits with cables in them shall be permanently sealed by firmly packing the void around the cable with oakum and capping with a hydraulic cement or water proof duct seal.

3.3. EXPOSED SERVICE PENETRATIONS IN CEILING OF UNDERGROUND PARKING AREAS

3.3.1. Where the bottom of a Fire Stop System is exposed, seal bottom side of the assembly with a fire rated elastomeric Fire Stop sealant.

3.4. CLEAN UP

3.4.1. Remove excess materials and debris and clean adjacent surfaces immediately after application to satisfaction of the Telecommunications Engineer’s Representative. Remove and or correct staining and discolouring of adjacent surfaces as directed.

END OF SECTION

27 00 07.10 Cable and Equipment Removal

1. General

1.1. WORK INCLUDED

1.1.1. Labour Allowance

.1 Allow for cable removal in the contract, based on the scope of Work indicated in this section and on any associated demolition Drawings.

.2 Confirm with the Telecommunications Engineer's Representative prior to any cable being removed. Forward a schedule indicating the locations and times for cable removal to the Telecommunications Engineer's Representative.

.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 Owner.

1.1.2. Cable and Equipment Removal

.1 Include the extent of demolition work in the contract which is delineated in demolition Drawings and associated detail Drawings.

.2 Where identified on drawings, remove 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. 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 Consult with the owner and determine the equipment required to be online 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 the cost of premium time in the contract for Work during nights, weekends, holidays, or other time outside normal working hours necessary to maintain all Telecommunications services in operation.

.7 Scope of Demolition:

.1 Include removal, relocation and reinstallation of Telecommunications devices/systems/infrastructures in the areas noted on the Drawings. This shall include, but is not limited to:

.1 Disconnection, removal and/or reinstallation of all Telecommunications devices/systems/infrastructures to accommodate new Work. Refer to relevant electrical, architectural, structural, mechanical, and other project design 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.

.4 Disconnect and remove all existing services, devices and wiring materials which are abandoned.

.5 Trace and identify all Telecommunications devices/systems/infrastructure for review by the Telecommunications Engineer's Representative and/or Owner in order to determine if services are to remain or to be removed. Once identified, the Telecommunications Contractor must remove those as directed.

.8 Disposal of Materials

.1 Dispose of all material removed from the site in accordance with all applicable environmental legislation and regulations 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 project manager.

.2 Do not resume Work in affected area without approval from the project manager.

2. Products

2.1. NOT USED

3. Execution

3.1. CABLE IDENTIFICATION

3.1.1. Prior to removal of Telecommunications cabling, identify all existing non-active cabling (as well as active cabling to remain), and verify the location and extent of removal with the Owner. Tone 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. Turn over to the Owner all racks, cabinets, accessories, patch panels and voice connectivity hardware. If items are not to be re-used, confirm disposal with the Project Team prior to disposal.

3.2.3. Dispose of on a daily basis all cabling and components that are removed. Include all costs of removal and disposal in the contract 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 the Drawings shall be maintained in operation during the construction phase. Provide new wiring for any existing systems to remain so that the existing systems do not interfere with the Work. Remove 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 outlets within the renovated area and adjacent areas. Mark this information on a set of drawing prior to any Work commencing as these circuits will be reused as part of this work as noted on the Drawings or called for in the contract documents.

3.3.5. Clean and test existing equipment/cabling which is to remain and equipment/cabling being reinstalled in areas being renovated for proper operation and repair as necessary before being put back into service.

3.3.6. Verify operation of all existing devices and report any discrepancies to the Communications Engineer's Representative and/or Owner prior to proceeding with the Work.

3.3.7. Unless noted otherwise provide additional equipment of the same type and 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 05.70 – PROJECT SPECIFIC REQUIREMENTS, make 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 05 28.00 Pathways for Telecommunications Systems

1. General

1.1. WORK INCLUDED

1.1.1. Supply and install cabling as detailed in the Contract Documents. Use pathways installed by the Electrical Contractor 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.

1.1.2. Do not use any mechanical or electrical fittings to support the Telecommunications cabling.

1.1.3. Independently support the cables above all ceiling tiles in such a manner that the cables do not interfere with the removal of the ceiling tiles. Maintain a minimum of 75 mm 3”(in) of clear vertical space above the ceiling tiles shall .

1.1.4. Obtain the Telecommunications Engineer’s Representative approval for 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, Telecommunications cable tray, ducts, surface raceways installed by the Electrical Contractor, and furniture system channels except where otherwise noted.

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”) | | |

2. Products

2.1. NON-CONTINUOUS CABLE SUPPORT

2.1.1. Supply and install cable support for the distribution of horizontal and backbone cables where conduit or cable tray has not been provided.

2.1.2. Use non-continuous cable supports up to the maximum density of cables permitted, as specified by the manufacturer.

2.1.3. Provide adequate supports to suit the quantity of cables in runs used for distribution.

2.1.4. Include any other miscellaneous hardware (angled hanger bracket, hammer/screw on clamps) required to support horizontal and backbone cabling.

2.1.5. Approved Manufacturers:

.1 Erico,

.2 Panduit, or

.3 An equivalent and sized as per manufacturer recommendations.

2.1.6. Approved Products

.1 Panduit J-Pro, J-Mod, or equivalent cable supports shall be used where ceiling space rating dictates.

| Description | Panduit Part# | J-Mod |
|---|---|---|
| Wall Mount | JP2W-L20 | Equivalent |
| Ceiling Mount | JP2CMB-L20 SPEC | Equivalent |
| Drop Wire and Threaded Rod Clip | JP2DW-L20 | Equivalent |
| Screw-On Beam Clamps | JP2SBC50-L20 or JP2SBC50RB-L20 | Equivalent |
| Hammer On Beam Clamps | JP2HBC25RB-L20 or JP2HBC50RB-L20 or JP2HBC75RB-L20 | Equivalent |
| Purlin Clips | JP2ZP-L20 or JP2CP-L20 | Equivalent |
| Under Floor Pedestal Support Clamp | JP2UF100-L20 | Equivalent |

2.2. VELCRO STRAPS

2.2.1. Provide only Velcro straps for bundling of cable. Under no circumstance shall plastic tie-wraps be used.

2.2.2. Acceptable Manufacturers

.1 Panduit: HLS/HLM-15R0 (Black), or

.2 Approved equivalent

2.2.3. If plastic tie-wraps are used the Telecommunications Contractor shall remove and replace all affected cables at their own expense.

2.3. SPIRAL WRAP

2.3.1. 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.

2.3.2. Approved Manufacturers:

.1 Panduit part number: T50F-CX, or

.2 Approved equivalent.

3. Execution

3.1. CABLE DISTRIBUTION

3.1.1. 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.

3.1.2. Install and terminate all cables and components in accordance with applicable Codes, Standards and Regulations.

3.2. CABLE SUPPORT

3.2.1. 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 Contractor as indicated on Division 27 Drawings, unless otherwise noted. Telecommunications Contractor is responsible for determining these requirements based on Telecommunications and/or Electrical Drawings.

3.2.2. Install hangars at 4' intervals (maximum). Do not exceed a cable sag greater than 4". Secure all cables to J-hooks/supports with Velcro straps. Comb and dress cables for all visible portions of the install. Comb and redress any cables that do not meet this criteria at no additional cost.

3.2.3. Run all cable support hangers and inner duct parallel to building lines.

3.2.4. Cable support hangers or hanger supports must not be drilled into post-tensioned beams under any circumstances.

3.2.5. Be responsible for coordinating the best time to install the supports with the General Contractor. After hours Work may be required for this portion of the Work.

3.2.6. Size supports to accommodate the number of cables in each run. Provide other hardware such as hammer on clamps, screw on clamps and angled hanger brackets to support the backbone and/or horizontal cabling.

3.2.7. In the Cable Support Hanger System, each individual run or pathway shall not contain more than fifty (50) UTP horizontal cables. Provide an additional hanger pathway to divide the cable bundle where the quantity exceeds this.

3.2.8. Completely and independently support the hangar system from the structural ceiling or walls (concrete slab/deck). Do not support the cable support hanger system from the suspended ceiling. Do not drill anchors for hangers into post tensioned beams under any circumstances. Do not use pneumatic hammers. All anchors must be drilled into slab.

3.2.9. Minimize the disturbance or removal of 'fire spray' insulation during installation of cable supports.

3.3. VELCRO STRAPS

3.3.1. Use Velcro straps to neatly dress cables; they shall be placed at a maximum of 4' intervals for horizontal distribution (centre points between cable supports).

3.3.2. Use Velcro straps to dress horizontal cables into racks/cabinets. For each row of the patch panel, the 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.

3.4. SPIRAL WRAP

3.4.1. Install spiral wrap from system furniture feed points to system furniture entry point. Spiral Wrap shall be butted so that no cables are exposed.

3.5. CABLE DISTRIBUTION

3.5.1. Ensure ANSI/EIA/TIA-568.1, latest edition standard installation practices are followed for indoor cable distribution and ANSI/EIA/TIA-758, latest edition standard installation practices are followed for outdoor cable distribution.

3.5.2. Station personnel at each access point (i.e. Handhole, maintenance hole, etc.) to observe the cables being pulled. Submit tension pull calculation for installation of cables to Telecommunications Engineer's Representative.

3.5.3. Do not exceed the Copper/Fibre 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. Set the tension limit 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 Telecommunications Engineer's Representative, to prevent over tension on the cable.

3.5.4. Do not exceed the minimum bend radius as per the manufacturer's recommendations.

3.5.5. Make cable pulls continuous and steady between pull points. Do not interrupt the pull unless necessitated by excessive tension on the cable.

3.5.6. Protect exposed cable ends from moisture ingress.

3.5.7. Provide sufficient slack for cable passing through maintenance holes for expansion/contraction and install clips to prevent sagging.

3.6. CABLE LUBRICANT

3.6.1. The use of pulling lubricants of any kind is strictly prohibited

3.7. DUCT AND CONDUIT

3.7.1. 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 Telecommunications cables. When cleaning ducts, if obstructions are encountered which cannot be removed, advise the Telecommunications Engineer's Representative of the problems encountered.

3.7.2. Pull cables in bottom ducts/conduits first, leaving top ducts/conduits for future use. 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 53.00 Identification for Telecommunications Systems

1. General

1.1. WORK INCLUDED

1.1.1. Labelling

.1 Confirm the cable designations with the Telecommunications Engineer's Representative prior to installation.

.2 Adhere to CSA T528-93 (ANSI/EIA/TIA-606-C) colour codes.

.3 Confirm labelling schemes with the Telecommunications Engineer's Representative prior to installation. The cable labelling scheme for all cables at both ends shall be as follows:

1.1.2. Horizontal Cable Labelling Schema

.1 Provide labelling schema for Horizontal Voice/Data cables and IDC Blocks / Patch Panels shall be as follows:

.2 TX. Y Where

.3 T indicates type of cable: Voice (V) or Data (D).

.4 X indicates the floor,

.5 Z indicates the Telecom Room the cable is terminated in, and

.6 Y indicates the Cable Number (numeric) 001… highest cable number.

.7 Example: D7.017

.8 D indicates data,

.9 7 indicates 7th floor,

.10 A indicates the cable is terminated in Telecom Room A, and

.11 .017 indicates the 17th Cable.

2. Products

2.1. CABLE LABELS

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. Provide self-laminating vinyl cable labels with a white printing area and a clear tail that self laminates the printed area when wrapped around a cable. The clear area shall be of sufficient length to wrap around the cable at least one and one-half times.

2.1.3. Approved Manufacturers:

.1 Panduit: Part# LS8E,

.2 Easy-mark labeling software: Part# PROG-EMCD, or

.3 Equivalent.

2.2. LAMACOID LABELS

2.2.1. Provide black lamacoid plates with white 60 point Arial Narrow, engraved upper case letters enclosed by a white border on black background for racks, cabinets, and enclosures.

3. Execution

3.1. INSTALLATION

3.1.1. All active and passive equipment shall be labeled.

3.2. LABELLING

3.2.1. All labels must be mechanically printed using a laser printer. Hand-written labels are not permitted.

3.2.2. Provide 25% spare labels in each telecommunications room.

3.3. LABEL LOCATIONS

3.3.1. 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 IDC termination blocks,

.4 Front of workstation/Telecommunications outlet faceplates, and

.5 Each end of each Telecommunications Conduit.

3.3.2. Labels must be visible during installation and normal maintenance of the infrastructure.

3.3.3. Affix lamacoid labels to the front and rear of equipment in racks, cabinets.

END OF SECTION

27 08 00.00 Commissioning for Telecommunications Sections

1. General

1.1. WORK INCLUDED

1.1.1. General Testing Requirements

.1 Test 100% of the installed cabling links. All cables must pass the requirements of the Standards as defined within this document. Any failing link must be diagnosed and corrected. Re-test to prove that the corrected link meets the performance requirements. Provide the final and passing result of the tests for all links in the test results documentation.

.2 Correct all deficiencies before the Telecommunications Engineer's Representative will provide a certificate to release the Holdback on the project.

.3 Submit a soft copy of test results in PDF and another ODBC compatible database format.

.4 Test Patch Cords for 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 Submit a test plan to the Telecommunications Engineer's Representative for approval prior to testing.

.6 Submit a test report based on the cable schedules. 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. An authorised person shall sign the test report at the completion of the project.

1.1.2. Copper Cabling Test Requirements

.1 Test every cabling link in the installation (as required by the Cabling specified) in accordance with the Telecommunications Industry Association (TIA) Standard ANSI/TIA/EIA-568.1, latest edition.

.2 Test installed twisted-pair horizontal links from the Telecommunications Room to the workstation against the "Permanent Link" performance limits Specification as defined in ANSI/TIA/EIA-568.1, latest edition .

.3 Only trained technicians who have successfully attended an appropriate training program and have been certified must 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 Test equipment shall comply with or exceed the accuracy requirements for enhanced level II and/or level III and/or level IIIe field testers (according to Cabling specified) as defined in TIA-568, latest edition ; 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, latest edition .

.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. Provide proof that the interface has been calibrated within the period recommended by the Manufacturer. 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. Submit all Pass* categorized cable test results to the Owners' Engineering Representative for review and approval. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. (Reference TIA-568, latest edition ; Annex I: Section I.2.2).

1.1.3. Copper Cabling Performance Test Parameters

.1 The test parameters for Category 6a are defined in TIA Category 6a Standard, which refers to TIA/EIA-568.2, latest edition. The test of each link shall contain all of the following parameters as detailed below. In order to pass the test all measurements (at each frequency in the range from 1 MHz through 500 MHz) must meet or exceed the limit value determined in the above-mentioned Standard.

.2 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 Attenuation,

.4 NEXT/FEXT,

.5 ACR,

.6 Return Loss,

.7 ELFEXT, PSELFEXT,

.8 Propagation Delay, Delay skew, and

.9 PSNEXT, PSACR.

.3 Permanent link testing of all horizontal and backbone cables shall 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, and

.3 Basic Link.

.4 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. Optical Fibre Cabling Test Requirements

.1 Every Optical Fibre Cabling link in the installation shall be tested in accordance with the field test Specifications defined by the Telecommunications Industry Association (TIA)

Standard ANSI/TIA/EIA-568, latest edition (or by the appropriate network application Standard(s) whichever is more demanding).

.2 ANSI/TIA/EIA-568, latest edition, defines the passive cabling network to include cable, connectors, and splices (if present), between two optical fibre patch panels (connecting hardware). A typical horizontal link segment is from the telecommunications outlet/connector to the horizontal cross-connect. This TIA document describes three typical backbone link segments: (1) main cross-connect to intermediate cross-connect, (2) main cross-connect to horizontal cross-connect, or (3) intermediate cross-connect to horizontal cross-connect. The test shall include the representative connector performance at the connecting hardware associated with the mating of patch cords. The test does not, however, include the performance of the connector at the interface with the test equipment.

.3 Only trained technicians who have successfully attended an appropriate training program and have been certified must execute the tests. These certificates may have been issued by any of the following organisations or an equivalent organisation:

.1 The manufacturer of the Optical Fibre Cable and/or the Optical Fibre Connectors,

.2 The manufacturer of the test equipment used for the field certification,

.3 Training organisations authorised by BICSI (Building Industry Consulting Services International) or by the ACP (Association of Cabling Professionals™), or

.4 Vendor supplied certifications for their product.

.4 Field test instruments for Multimode Fibre cabling shall meet the requirements of ANSI/TIA/EIA-526-14, latest edition. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50, latest edition; Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA/EIA-568.1, latest edition) with a Category 1 light source. Field test instruments for Single mode Fibre cabling shall meet the requirements of ANSI/EIA/TIA-526-7, latest edition.

.5 The Optical Fibre launch cables and adapters must be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters.

.6 The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests as detailed below.

.7 A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.

## 2. Products

### 2.1. APPROVED MANUFACTURERS

#### 2.1.1. Copper Testers

.1 HP/Agilent,

.2 OMNI Scanner, or

.3 Fluke DSP-4000.

2.2. WARRANTY AND CERTIFICATION

2.2.1. Provide to Owner, one system certification at the end of the project.

3. Execution

3.1. WARRANTY AND CERTIFICATION REQUIREMENTS

3.1.1. Submit the Structured Cabling Solution certification and the user manual.

3.1.2. Provide letter(s) of Certification within two weeks of the date of substantial performance of the contract of the project to the Telecommunications Engineer's Representative. This document will include the following:

.1 Verification of the performance of the installed system,

.2 Identification of the installation by location and project number, and

.3 A copy of the Warranty.

3.1.3. Within 7 days of the award of contract, submit copies of the Structured Cabling Solution certification request for Certification form complete with certification number(s) for the project. Provide a copy of the form with Specification submission.

END OF SECTION

# 27 11 16.00 Telecommunications Cabinets, Racks, Frames and Enclosures

## 1. General

### 1.1. WORK INCLUDED

#### 1.1.1. Equipment Locations

.1 Devices, Racks, Cabinets, Brackets and Backboards 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.

#### 1.1.2. Telecommunication Racks and Cabinets

.1 Provide all wall mount brackets, racks, cabinets and components as indicated in this document and on the Contract drawings.

.2 Provide all racks, cabinets, wall mount brackets and components from the same manufacturer and identical style shall be used throughout the project, unless specifically noted in this section.

.3 All racks, cabinets, wall mount brackets and components shall meet or exceed requirements as defined by ANSI/EIA-310-E, Cabinets, Racks, Panels and Associated Equipment.

.4 All racks, cabinets, wall mount brackets and components required for this project will be reflected on Telecommunications Room Layout & Rack Elevation Detail drawings (If required).

.5 At a minimum, provide one (1) new 2U horizontal cable management panel for each new patch panel installed, when no rack elevation drawing is provided. Quantities shown on rack elevation drawing(s) shall supersede this requirement.

.6 In all cases wall mount brackets, racks, cabinets and components shall be powder-coated black.

.7 Approved Manufacturers:

.1 APC by Schneider Electric,

.2 Belden Incorporated,

.3 D.L. Custom,

.4 Hammond Manufacturing Company Limited,

.5 International ElectronMetal,

.6 Panduit Corporation, or

.7 R.F. Mote Limited.

#### 1.1.3. Cabling

.1 Reference General requirements and the Execution requirements as applicable under Section 27 15 00.19 DATA TELECOMMUNICATIONS HORIZONTAL CABLING.

## 2. Products

### 2.1. TELECOMMUNICATIONS RACK & CABINET COMPONENTS

#### 2.1.1. Vertical Cable Managers

.1 Constructed of minimum 16 GA (0.060”) steel with stiffeners riveted/welded inside for additional strength.

.2 Management panels shall have a hinged door with nonmagnetic closing mechanism. A fully shielded magnetic closing mechanism shall also be accepted.

.3 Openings for cable routing shall have grommets to ensure smooth transition of the cables.

.4 Management panels shall have lancets along the back of the cable manager to allow for the fastening of the cable(s) to the outside of the manager itself.

2.1.2. Horizontal Cable Management Panel

.1 Welded construction, fabricated of a minimum of 16 GA (0.060”) steel & shall be a minimum of 2U and 76mm (3”)D.

.2 Panel shall have hinged cover with nonmagnetic closing mechanism. A fully shielded magnetic closing mechanism shall also be accepted.

.3 Openings for cable routing shall have grommets to ensure smooth transition of the cables.

2.1.3. Shelves

.1 Welded construction, fabricated of a minimum of 16 GA (0.060”) steel, and mountable into 19” EIA rack / cabinet frames

.2 Shelf style shall be 4-point mount and vented.

3. Execution

3.1. TELECOMMUNICATIONS WALL MOUNT BRACKETS, RACKS, CABINETS AND COMPONENTS

3.1.1. Properly secure the racks on top of the finished floor and wall. Ground all racks and cabinets in accordance with the parameters within this specification document.

3.1.2. Refer to detail drawings for location(s) of Telecommunications wall mount brackets, racks and cabinets.

3.1.3. Provide all Telecommunications rack and cabinet components as per the detail drawings. Provide (including levelling and ganging) all racks, cabinets and their components for a complete functioning system.

3.1.4. Secure all wall mounted equipment (i.e. rotating rack & wall mount cabinet) backboards.

3.2. TELECOMMUNICATIONS RACK & CABINET COMPONENTS

3.2.1. Vertical Cable Managers

.1 Install two (2) vertical cable managers for each floor/wall mount rack, except where racks are ganged together.

.2 Where racks are ganged together, provide one (1) vertical cable manager between racks.

.3 For cabinets, provide minimum size of 215mm (8.5”) W x 150mm (6”) D vertical cable manager on each side of each cabinet. Two vertical Cable Managers shall be installed for each floor mount cabinet.

3.2.2. Horizontal Cable Management Panel

.1 Install one horizontal cable manager per rack plus an additional one for every patch panel and every network switch when no rack elevation is provided, otherwise quantities on rack elevation drawing supersede this requirement. Assume 48 port switches, one port for every horizontal cable installed.

3.2.3. Shelves

.1 Provide rack mounted shelves as indicated on detail drawings.

END OF SECTION

27 11 19.00 Telecommunications Termination Blocks and Patch Panels

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR TELECOMMUNICATIONS 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) 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. Colour: Black

3. Execution

3.1. PATCH PANELS

3.1.1. 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. END OF section

# 27 15 00.19 Data Telecommunications Horizontal Cabling

## 1. General

### 1.1. WORK INCLUDED

1.1.1. Supply and install cabling as detailed in the Contract Documents. The Telecommunications Contractor shall use pathways by the Electrical Contractor to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point they shall use cable support hangars.

1.1.2. Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connectorization and future moves.

1.1.3. 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 Telecommunications Engineer's Representative 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 Telecommunications Engineer's Representative shall determine the quality of workmanship during installation. Cables that have not been properly installed will be reinstalled by the Telecommunications Contractor 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 Telecommunications Engineer's Representative prior to installation.

1.2.2. Any deviation from the cable routing, outlet and equipment locations shown on drawings must be approved by the Telecommunications Engineer's Representative 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 #22-26 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 |
| Wireless Access Point | Blue |

3. Execution

3.1. GENERAL CONDITIONS

3.1.1. 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 Engineer’s Representative.

3.2. INSTALLATION

3.2.1. Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. Replace damaged cables without any additional compensation.

3.3. HORIZONTAL CABLE DISTRIBUTION

3.3.1. 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.

3.3.2. Follow proper installation and termination practices for UTP copper and Optical Fibre 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. For Optical Fibre cables maintain a minimum of ten (10) times the cable diameter or 30 mm (1.2”) whichever is larger for a bend radius.

3.3.3. Bundle all horizontal cables on the Telecommunications Racks using Velcro straps. Separate Voice, Data and fibre cables into separate distinct bundles for identification purposes where applicable.

3.3.4. Strap bundles in Telecommunications rooms, at a maximum of 203 mm 8”(in) separation. Bundles shall contain no more than fifty (50) cables to eliminate any excessive stress on the cable jackets.

3.3.5. 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.

3.3.6. 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.

3.3.7. Route/install Telecommunications cabling in systems furniture, lab casework furniture & mill work as denoted on floor plans.

3.3.8. Provide Data cables to each outlet indicated on the drawings. The Telecommunications Contractor shall refer to the legends on the drawing to determine the number of cables to each outlet location.

3.3.9. Terminate test and label each cable in accordance to the parameters stated in this specification document.

3.3.10. Ground all cables and components to manufacturer's specifications and standard practices.

END OF SECTION

27 15 43.00 Telecommunications Faceplates and Connectors

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR TELECOMMUNICATIONS 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 Telecommunications receptacles are ganged together, cover plates shall be supplied and installed by the Electrical Contractor, unless otherwise noted. Where Telecommunications receptacles are stand alone or separate from Electrical receptacles, cover plates shall be supplied and installed by the Telecommunications Contractor.

2. Products

2.1. EIGHT-POSITION MODULAR CONNECTORS

2.1.1. The eight-position modular connectors must be matched appropriately with the cables to ensure that end to end Manufacturer 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 work station locations, surface raceway, or surface mount boxes.

2.1.4. All Data and Voice modules shall have the following minimum performance parameters:

.1 Modular Jack Current rating: 1.5 amperes maximum

.2 Modular Jack Durability: 1,000 mating cycles

.3 Modular Jack Contact Pressure: 100 grams, minimum per contact

.4 Dielectric Voltage Strength: 1,000 V RMS at 60 Hz for 1 minute

.5 Insulation Resistance: 200 MΩ minimum

.6 Contact Resistance: 1 M Ω 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 |
| Wireless Access Point | Yellow | 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. Modular Furniture Faceplate

2.2.2. Use 3 or 4-port modular furniture faceplate adapters for furniture outlets that have modular furniture knockouts. Equip each outlet with the appropriate UTP modules as indicated in this section.

2.2.3. Use recessed blanks for all unused ports. Blanks must match the frame colour.

2.2.4. Verify furniture manufacturer prior to ordering.

2.2.5. Provide a ½“ spacer/adapter, if required, to ensure faceplate can be properly installed on systems furniture maintaining proper bend radius

2.3. WALL FACEPLATE

2.3.1. Provide all faceplates for wall boxes designated for Telecommunications use that are not ganged with electrical outlet boxes.

2.3.2. UTP Cables

.1 Faceplate colour and type (decora/modular style) shall match electrical. Visible mounting screws shall match the finish of their faceplate.

.2 Frames shall be 4 or 6-port frame (non-decora).

.3 Use recessed blanks for all unused ports. Blanks must match frame colour.

.4 Some locations on the floor plans may indicate a wall mount telephone. Provide a wall mount faceplate suitable for wall mounting a telephone set in these locations.

2.3.3. Approved manufacturers are as follows:

.1 Thomas and Betts,

.2 Commscope,

.3 Panduit, or

.4 Equivalent.

2.4. DECORA ADAPTERS

2.4.1. UTP Cables

.1 Where Telecommunications wall boxes are ganged with electrical outlet boxes, floor or raceway outlets shall utilise 3 or 4-port Decora style adapters/inserts. Equip each outlet with the appropriate UTP modules as indicated in this section.

.2 Provide all Telecommunications workstation adapters/inserts for all Telecommunications outlets (ganged or single) when decora style faceplates are utilized. Provide decora style faceplates for all Telecommunications wall box locations where not ganged with Electrical.

2.4.2. Approved Manufacturers

.1 Thomas and Betts,

.2 Commscope,

.3 Panduit, or

.4 Equivalent.

2.5. BLANK INSERTS

2.5.1. Install Blank Inserts in unused Telecommunications ports. Blank inserts shall match faceplates.

2.6. SURFACE MOUNT BOXES

2.6.1. All systems furniture raceways that do not have a modular furniture knockout shall utilise 2- or 4-port surface mount boxes. Each outlet shall be equipped with the appropriate UTP modules as indicated in this section.

2.7. FLOOR MONUMENT

2.7.1. Floor monuments and faceplates shall be provided by Division 26 (Electrical). Refer to Division 26 Specifications and Drawings for further information

2.7.2. Telecommunications Contractor shall determine type of module required to suit floor monument (i.e. MDVO, Keystone, etc.)

2.7.3. Where applicable, use recessed blanks for all unused ports. Blanks to match faceplate colour.

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. 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. Verify the position of jacks with the Telecommunications Engineer’s Representative prior to installation.

3.2.2. Modular Furniture Faceplate

.1 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 |

3.2.3. Wall Faceplate

.1 The orientation of the Data and Voice modules at the Workstation from the perspective of the user is as indicated below:

| | | | |
|---|---|---|---|
| Data 1 | Top Left | Data 1 | Bottom Left |

| | | | | |
|---|---|---|---|---|
| Data 2 | Top Right | or | Data 2 | Top Left |
| Voice 1 | Bottom Left | | Voice 1 | Bottom Right |
| Voice 2 | Bottom Right | | Voice 2 | Top Right |

3.2.4. Decora Adapters

.1 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 |

3.2.5. Surface Boxes

.1 The orientation of the Data and Voice modules at the Workstation from the perspective of the user is as indicated below:

| | | | | |
|---|---|---|---|---|
| Data 1 | Top Left | | Data 1 | Bottom Left |
| Data 2 | Top Right | or | Data 2 | Top Left |
| Voice 1 | Bottom Left | | Voice 1 | Bottom Right |
| Voice 2 | Bottom Right | | Voice 2 | Top Right |

3.3. COVER PLATES AND DECORA STYLE BLANKS

3.3.1. Provide cover plates and decora style blanks to all unused Telecommunications rough-ins.

3.4. BLANK INSERTS

3.4.1. All unused Telecommunications ports must be installed with blank inserts. For copper patch panels, use Black. For workstation outlets match existing/electrical.

END OF SECTION

27 16 19.00 Telecommunications Patch Cords and Cross Connect Wire

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 27 00 05.10 – GENERAL INSTRUCTIONS FOR TELECOMMUNICATIONS SECTIONS.

1.2. COPPER PATCH CORDS

1.2.1. Connect UTP Patch Cords in the Telecom Room to the 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 diameter, grade, and manufacturer of the Telecommunications cable that is being Warranted.

2. Products

2.1. UTP PATCH CORDS AND PIGTAIL ASSEMBLIES

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 diameter grade and manufacturer of the Telecommunications cable that is being warranted.

2.1.3. Patch cords shall 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 and pigtail assemblies to be factory assembled and not site prepared, complete with snag less boot.

2.1.5. Patch Cord / Pigtail requirements:

| Designation | Termination | Colour | Length | Location |
|---|---|---|---|---|
| Data | RJ45/RJ45 | Blue | 7' (ft) 2.13m | Telecom. Room |
| Data | RJ45/RJ45 | Blue | 10' (ft) 3m | Workstation |
| Wireless Access Point | RJ45/RJ45 | Blue | 7' (ft) 2.13m | Telecom. Room |
| Wireless Access Point | RJ45/RJ45 | Blue | 10' (ft) 3m | Workstation |

3. Execution

3.1. INSTALLATION

3.1.1. Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. The Telecommunications Contractor without any additional compensation shall replace damaged cables.

3.2. UTP COPPER PATCH CORDS

3.2.1. At Telecommunications Room end, provide one (1) patch cord for each data cable installed. Communications Contractor shall be responsible for patching all data cabling. A patching schedule shall be provided to the Communications Contractor prior to installation. Patch Cords provided must maintain the Channel Solution.

3.2.2. At workstation end, provide one (1) patch cord for each data cable installed. Patch Cords supplied and installed must maintain the Channel Solution.

END OF SECTION

END OF SECTION 28 00 00.00

# 1. General

## 1.1. WORK INCLUDED

1.1.1. Bidders, will be responsible for reviewing the bid documents, an ensuring their subcontractors, Product and material Suppliers review the Bid Documents, prior to submitting a bid to ensure they have an overall understanding of the entire Project's scope of work. Electrical Subcontractors are specifically instructed to review non-electrical parts of the Bid Documents for additional information and details related to their trades.

1.1.2. Conform to the requirements of the Region, which apply to and form part of all sections of the work.

1.1.3. Where there is a conflict between the requirements outlined in this Electronic Safety and Security specifications document and requirements indicated in the Region more stringent and/or more onerous requirement shall apply.

1.1.4. Read and comply with all sections of this document.

1.1.5. The Specification is divided into Sections which are not intended to identify contractual limits between Sub-Contractors nor between the Contractor and Sub-Contractors. The requirements of any one Section apply to all Sections. Refer to other Divisions and Sections to ensure a complete and operational system.

1.1.6. Provide Electronic Safety and Security components and accessories which may not be specifically shown on the Drawings or stipulated in the Specifications, but are required to ensure complete and operational systems.

1.1.7. Provide all labour, materials, tools, and equipment required for the complete installation, commissioning and start-up of Electronic Safety and Security systems called for in all sections of the Contract Documents.

## 1.2. QUALIFIED CONTRACTORS

1.2.1. HONEYWELL EBI SECURITY SYSTEM INSTALLERS

1.2.2. Security Control System design (riser layouts), electrical/IT requirements are to be provided and reviewed by Honeywell's Project Manger who can be contacted as follows:

Honeywell
Account Executive: Marc Kingsbury
85 Enterprise Blvd
Markham, Ontario L6G 0B5
(289) 333-1333 fax
(416) 895-7926 Mobile

1.2.3. Installation and integration of the Honeywell EBI security system(s) shall be completed by, one of the installers listed herein.

1.2.4. Approved EBI System Installers (alphabetical order)

.1 Ontario Electric Construction Company Limited

7 Compass Court
Scarborough, Ontario
M1S 5N3
Contact: Ryan Charlton – Chief Estimator
ryancharlton@onelec.com
Phone: 416-363-5741 x 266

.2 Plan Group

27 Vanley Cres.
North York, Ontario
M3J 2B7
Contact: Tom Nanou – Project Manager
tnanou@plan-group.com
Phone: 416-678-7353

.3 T.C. Securities Corp.

313 Albert Street
Oshawa, Ontario
L1H 4R9
Contact: Dondi Keough
Dondi@tcsecure.ca
Phone: 416-429-7180

.4 OZZ Electric Inc.

20 Floral Parkway
Concord, Ontario
L4K 4R1
Contact: Mr. Paul Sheppard, Service/Cabling Manager
psheppard@ozzelectric.com
Phone: 416-678-3029

.5 Symtech

35 Riviera Drive, Unit 9&10
Markham, Ontario
L3R 8N4
Contact: Adrian Masci-Account Executive
Adrian.masci@symtech.com
Phone: 416-559-5063

1.3. SECTIONS AFFECTED

1.3.1. These instructions apply to and form a part of all Electronic Safety and Security Sections.

1.4. SCOPE OF WORK

1.4.1. Include all necessary wiring, cabling, labor, tools, equipment, and ancillary materials required to furnish and install complete and operational Electronic Safety and Security Systems.

1.4.2. This specification includes a general description as well detailed functional and technical requirements for the Electronic Safety and Security Systems.

1.4.3. This specification provides all information necessary to produce a complete proposal for scalable multi-user, multi-tasking Electronic Safety and Security Systems. The Electronic Safety and Security Systems shall include all computer hardware and software, controllers, interfaces, card readers/keypads, credentials, video recorders, cameras, alarm sensing devices, communication devices, electric door locking hardware, power supplies, cable/wire, conduit, raceways, enclosures, mounting hardware, and all other equipment as indicated on contract drawings and as specified herein. Except where noted to reuse exiting, all materials shall be new, commercial grade and of good quality.

1.4.4. This project consists of the **complete supply, installation and commissioning** of the following Electronic Safety and Security systems:

.1 Access Control Additions

1.4.5. All Electronic Safety and Security systems supplied and installed shall be turnkey complete and fully operational. All Electronic Safety and Security systems shall be integrated as per the contract drawings and specifications.

1.4.6. The Electronic Safety and Security Systems shall be installed based on the drawing documents provided herewith.

1.4.7. All cables for the Electronic Safety and Security Systems shall be installed via conduits and or cable tray.

1.4.8. Conduit shall be supplied and installed as indicated drawings unless otherwise noted.

1.4.9. The scope of work shall include but shall not be limited to:

.1 Decommission and remove all existing redundant cabling and existing redundant devices as indicated on contract drawings.

.2 Where existing devices are to remain, provide all wiring, active and passive devices as required and as indicated on contract drawings to facilitate connectivity and complete operation of said existing devices.

.3 Supply and installation of cable supports for all cabling. Co-ordinate on site for interferences and with other disciplines / trades. All cable supports shall be installed following building lines, and in accordance with the building's requirements / guidelines.

.4 Supply and installation of all active and passive hardware and cables as specified within this document to support the Electronic Safety and Security Systems.

.5 Where active and passive hardware and cabling is not specified but are required to make the Electronic Safety and Security Systems turnkey and to meet the intent, supply and install such active and passive hardware and cabling at no extra cost.

.6 Supply and installation of equipment cabinets, complete with all accessories.

.7 Supply and installation of backboards.

.8 Supply and installation of all fire stop materials / mechanisms for all penetrations.

1.4.10. While every attempt has been made to ensure all information is correct at the time of publication, the products specified are available and that the part numbers identified are correct, verify all part numbers and to report any errors and/or omissions in this Specification with their bid submissions.

1.4.11. This document and all related drawings shall be read in conjunction with the project related Door Schedule and Door Hardware Schedule.

1.4.12. Dimensions shown on Contract Drawings are approximate. Verify dimensions by reference to shop drawings and field measurements.

1.4.13. Quantities or lengths indicated in any of the Contract Documents are approximate only and shall not be held to gauge or limit the work.

1.4.14. Include in bid all labour, materials, plant, transportation, storage costs, training, equipment, insurance, temporary protection, permits, reviews, bonding, taxes and all necessary and related items required to provide a complete and operational Electronic Safety and Security Systems.

1.5. INTENT

1.5.1. The Specifications are an integral part of the accompanying Drawings. Any item or subject omitted from one or the other, but which is either mentioned or reasonably implied, shall be considered as properly and sufficiently specified.

1.5.2. Be completely responsible for the acceptable condition and operation of all systems, equipment and components forming part of the installation or directly associated with it. Promptly replace defective material, equipment and repair related damages. The replacement of equipment and repair to damages shall be coordinated with other trades completed in a timely fashion so as not to affect the complete construction of the Electronic Safety and Security Systems and/or work by other.

1.6. BIDDER INQUIRIES

1.6.1. Left blank intentionally.

1.7. BID FORM AND SUBMISSION OF BIDS

1.7.1. Left blank intentionally.

1.8. PROGRESS DRAWS

1.8.1. Left blank intentionally.

1.9. HOLDBACK

1.9.1. Left blank intentionally.

1.10. SCHEDULE

1.10.1. Left blank intentionally.

1.11. LABOUR

1.11.1. Comply with all project job-site requirements for the duration of the project.

1.11.2. Do not assign or sub-contract any work without the prior **written consent** of the Project Manager. A list of sub-Contractors shall be submitted with the Tender response.

1.11.3. For all work related to this project, use only tradesmen who are fully trained, qualified and experienced on the installation and commissioning of the Electronic Safety and Security Systems.

1.11.4. DRAWINGS, CHANGES AND INSTALLATION

1.11.5. 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.

1.11.6. 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 right is reserved by the Electronic Safety and Security Engineer's Representative to make reasonable changes required to accommodate conditions arising during the progress of the work, at no extra cost.

1.11.7. 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.

1.11.8. The location and size of existing services shown on the drawings are based on the best available information. Verify the actual location of existing services in the field before commencing work.

1.11.9. At no extra cost, make all changes and modifications necessary to ensure co-ordination and to avoid interference and conflicts with other trades, or to accommodate existing conditions.

1.11.10. Leave areas clear where space is indicated as reserved for future equipment, and equipment for other trades.

1.11.11. Leave adequate space and provisions for removal of components and servicing of equipment, with minimum inconvenience to the operation of systems.

1.11.12. Where equipment is shown to be 'roughed in only' obtain accurate information from the Electronic Safety and Security Engineer's Representative before proceeding with the work.

1.11.13. Location of outlets, luminaires, diffusers, grilles, registers, thermostats, sprinklers and all other equipment shown on drawings (if shown) is diagrammatic.

1.11.14. Remedy any work not installed in correct location. Mark-out work and fully co-ordinate with all other trades. Review with Electronic Safety and Security Engineer's Representative prior to rough in. Prepare dimensioned layouts of each room prior to rough in for review by Electronic Safety and Security Engineer's Representative. Do not proceed with any work until the Electronic Safety and Security Engineer's Representative has reviewed and approved the layout drawings.

1.11.15. Conform to the York Region's Standards, Wiring and Tagging Standards, where applicable.

1.11.16. Approved Equal

1.11.17. Wherever the term "or approved equal" and or "approved equivalent" is used herein, it is to be understood that reference to the specified trade name, brand name, manufacturer's name, model number and/or catalogue number has been made solely for the purpose of indicating the minimum standard of quality required in material, workmanship and service. Any proposed alternate shall be submitted for review and acceptance prior to procurement and installation. The review and acceptance shall be at the sole discretion of The Region and their Engineer's Representatives.

1.12. SUBSTITUTIONS

1.12.1. Proposed substitutions in order to be assessed 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 jurisdictional authorities;

.4 Compliance with the applicable standards;

.5 Affect concerning compatibility with and interface with adjacent building materials and components;

.6 Compliance with the intent of the Contract Documents;

.7 Reasons for the request.

1.12.2. The Electronic Safety and Security Engineer's Representative'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 substitution will not be allowed.

1.13. CONFLICTING REQUIREMENTS

1.13.1. In the case of conflict or discrepancy in the requirements indicated in the contract documents the more stringent and/or more onerous requirement shall apply.

1.14. EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

1.14.1. Materials and equipment supplied by this Division shall be new and free from defects.

1.14.2. All equipment and material for which there is a listing service shall bear a UL/ULC and/or CSA label.

1.15. CO-OPERATION WITH OTHER DIVISIONS

1.15.1. Electronic Safety and Security cabling shall not touch or be supported from piping, ductwork, conduits, ceiling supports or any other structure / equipment. Electronic Safety and Security cabling shall be supported by ladder tray (where provided) or shall be installed within conduit (where provided).

1.15.2. Supply all items to be built in ample time for rapid progress of the work. Schedule and proceed with work as required to satisfy the construction schedule.

1.16. EXISTING SERVICES AND EQUIPMENT

1.16.1. All changes and connections to existing services shall be made only in a manner and at a time approved by the Safety and Security Engineer's Representative and/or The Region so as to avoid any interruption of such services during normal working hours. If necessary, changes and connections to existing services shall be made outside of normal working hours, at no extra cost to the Contract.

1.16.2. Where connections are made to existing services, existing fire stopping shall be made good under this Division.

1.17. METRIC CONVERSIONS

1.17.1. Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, but not limited to, equipment, material and site services in both new and existing installations.

1.18. SCHEDULE, ACCESS, PROTECTION AND CLEAN-UP

1.18.1. The construction schedule places restrictions on the duration of construction within areas and the duration of shut-down of equipment. Refer to the General Conditions for all requirements.

1.18.2. Refer to the General Conditions and conform to all requirements.

1.18.3. Refer to the security and protection requirements in the General Conditions and conform to all requirements. There shall be no smoking, and the site shall be kept clean at all times.

1.19. CUTTING, PATCHING AND REPAIRING

1.19.1. Perform all cutting, patching, repair and making good related to the Electronic Safety and Security Systems work including any penetrations through walls or floors.

1.19.2. Allow for all cost associated with cutting, patching, repair and making good related to the Electronic Safety and Security Systems work including any penetrations through walls or floors.

1.19.3. Paint all visible Electronic Safety and Security systems conduit to match existing.

1.19.4. Coordinate the color and location of all conduits, security devices and their housing with architect and architectural drawings on site prior to installation.

1.20. HOISTING FACILITIES

1.20.1. Provide all hoisting required to perform all work.

2. Products

2.1. ELECTRONIC SAFETY AND SECURITY SYSTEMS

2.1.1. Provide all materials as required for complete turnkey, end to end Electronic Safety and Security Systems.

2.1.2. All new equipment is to be supplied and installed by the Contractor unless existing equipment is verified to be functional and The Region has approved reuse of existing equipment.

2.1.3. Fasteners

.1 Provide security tamperproof fasteners for all visible exposed devices, equipment and components in all areas. Coordinate fastener type with the YORK REGION.

3. Execution

3.1. PRODUCT DELIVERY REQUIREMENTS

3.1.1. Unload 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. Be responsible for the assembly of above equipment/materials and protection of the above equipment and related items until project cut over. For any liable any damage to equipment. All damage shall be repaired or at The Region's request, the equipment shall be replaced at no extra charge to The Region.

3.3. ELECTRONIC SAFETY AND SECURITY SYSTEMS

3.3.1. Supply and install complete turnkey, end to end Electronic Safety and Security Systems.

3.4. WARRANTY MAINTENANCE SERVICES

3.4.1. Provide Warranty for the completed work to be free of defects in workmanship and materials for a period of two (2) years from the date of system acceptance and shall provide all necessary material required to replace defective products during this period.

3.4.2. If the workmanship or materials is found to be defective or not in accordance with the contract documents during the warranty period, correct it promptly with factory certified technicians at no cost. Provide all labor and materials to facilitate correction.

3.4.3. Warranty shall cover all installation for the Electronic Safety and Security Systems including but not limited to all hardware, hardware configurations, software, software configurations, wiring/cabling, conduit, pathways, and all active and passive components.

3.4.4. Provide maintenance at no extra cost during warranty period. The maintenance shall include but not limited to:

.1 Execute system heath check every 6 months during warranty period on all systems component including devices, cabling all passive and active hardware all software and firmware. Correct all defects and make all corrections to components and software to ensure the entire system is functioning optimally and according to manufacturer's recommendations.

3.4.5. General Requirements

.1 Provide all services required and equipment necessary to maintain all operations of the installed Electronic Safety and Security Systems during the period of the warranty.

3.4.6. Software

.1 Provide all available software and firmware updates during the period of the warranty and verify operation in the system. All updates shall be accomplished in a timely manner, fully coordinated with The Region's representatives, shall include training for the new changes/features enabled, and shall be incorporated into the operations and maintenance manuals, and software documentation.

3.4.7. Description of Work

.1 Provide respective systems manufacturer's required scheduled and unscheduled maintenance and all other work necessary to keep the system at its maximum performance.

3.4.8. Personnel

.1 Service personnel shall be factory certified in the maintenance and repair of the system equipment installed under this specification. The Region shall be advised in writing of the name of the designated service representative, and of any change in personnel.

3.4.9. Records and Logs

.1 Maintain records and logs of each task performed. Organize cumulative records for each component and for the complete system chronologically. A continuous log shall be maintained for all devices. The log shall contain all initial settings. Complete logs shall be kept and shall be available for inspection onsite, demonstrating that planned and systematic adjustments and repairs have been accomplished.

3.4.10. Work Requests

.1 Rerecord separately each service call request on a service request form. The form shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing what has to be done, the amount and nature of the materials used, the time and date work started, and the time and date of completion. The Contractor shall deliver a record of the work performed within five (5) days after work is accomplished.

3.4.11. System Modifications

.1 Make any recommendations for system modification in writing to The Region. No system modifications shall be made without prior approval of The Region. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.

END OF SECTION

1. General

1.1. NOT USED

1.2. DEFINITIONS

1.2.1. 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. |
| | | |
| Electronic Safety and Security Contractor | - | The successful bidder to this Specification responsible for the supply and installation of the Integrated Electronic Safety and Security Systems. |
| | | |
| Change Notice | - | Normative document approved to provide additional requirements and recommendations that describes and authorizes the implementation of an engineering change to the product and its approved configuration documentation. |
| | | |
| Electronic Safety and Security Engineer's Representative | - | Sal Ramo<br>Smith + Andersen<br>4211 Yonge Street, Suite 500<br>Toronto, ON M2P 2A9 |
| | | |
| Contemplated Change Notice | - | Normative document to provide additional requirements and recommendations that describes the implementation of an engineering change to the product and its approved configuration documentation for the purposes of pricing. This document does not authorize the implementation of a change to the product and its approved configuration documentation. |
| | | |
| Cut Over | - | The live date(s) when The Region will occupy the space as indicated by date and/or phasing. |

| | | |
|---|---|---|
| Contract Documents | - | All Electronic Safety And Security Systems / Security, Electrical, Architectural, Mechanical and Structural Drawings and specifications and schedules issued in relation to this project including any future changes and revisions of said documents. |
| Contract Drawings | - | All Electronic Safety And Security Systems / Security, Electrical, Architectural, Mechanical and Structural Drawings issued in relation to this project including any future changes and revisions of said documents. |
| Grounded Conductor | - | A system or circuit conductor that is intentionally grounded. |
| | | |
| Grounding System | - | A system of hardware and wiring that provides an electrical path from a specified location to an earth ground point. |
| | | |
| Project | - | Supply and installation of a complete Integrated Electronic Safety and Security Systems as described in this document. |
| | | |
| Provide | - | Supply, install and configure as per contract documents. |
| | | |
| Shop Drawing | - | Drawings, diagrams, illustrations, schedules, performance charts, and other data prepared by the contractor which illustrate how specific portions of the work shall be installed. This includes but not limited to point to point high level integration diagram, riser diagram, termination diagram, panel layout, door types and product data sheet. |

1.3. ABBREVIATIONS

1.3.1. 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 |
| CCN | - | Contemplated Change Notice |
| CCTV | - | Closed Circuit Television |
| CD | - | Compact Disc |
| CD | - | Change Directive (same as Change Notice and Change Order) |
| CEC | - | Canadian Electrical Code |
| CEF | - | Cable Entrance Facility |
| cm | - | Centimetre |
| CMP | - | Communications Plenum |
| CMR | - | Communications Riser |
| CN | - | Change Notice (same as Change Directive and Change Order) |
| CO | - | Change Order (same as Change Notice and Change Directive) |
| coax | - | Coaxial Cable |
| CO-OSP | - | Customer-Owned Outside Equipment |
| CP | - | Consolidation Point |
| CPU | - | Central Processing Unit |
| CPVC | - | Chlorinated Polyvinyl Chloride |
| CSA | - | Canadian Standards Institute |
| CSC | - | Construction Specifications Canada |
| CSI | - | Construction Specifications Institute |
| CT | - | Cable Tray |
| Cu | - | Copper |
| c/w | - | Complete With |
| dB | - | Decibel |
| dB/km | - | Decibel per Kilometre |
| dBm | - | Decibel milliwatt |
| dBmV | - | Decibel millivolt |
| demarc | - | Demarcation Point |
| D-ring | - | Distribution Ring |
| DSL | - | Digital Subscriber Line |
| EF | - | Entrance Facility |
| EIA | - | Electronics Industry Alliance |
| ELFEXT | - | Equal Level Far-End Crosstalk |
| ESSS | - | Electronic Safety and Security System/s |

| | | |
|---|---|---|
| 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 Closet |
| IC | - | Intermediate Cross-connect |
| ID | - | Identification |
| ID | - | Inside Diameter |
| IDC | - | Insulation Displacement Connection |
| IDC | - | Insulation Displacement Connector |
| IDC | - | Insulation Displacement Contact |
| IDF | - | Intermediate Distribution Frame |
| IEEE® | - | Institute of Electrical and Electronics Engineers, Inc.® |
| IG | - | Isolated Ground |
| in | - | Inch |
| $in^2$ | - | Square Inch |
| I/O | - | Input / Output (Device) |
| IOR | - | Index Of Refraction |
| IP | - | Internet Protocol |
| ISDN | - | Integrated Services Digital Network |
| ISO | - | International Organization for Standardization |
| IT | - | Information Technology |
| kb | - | Kilobit |
| kB | - | Kilobyte |
| kg | - | Kilogram |
| km | - | Kilometre |
| kV | - | Kilovolt |
| kVA | - | Kilovoltampere |
| kW | - | Kilowatt |
| kWh | - | Kilowatt hour |
| LAN | - | Local Area Network |
| laser | - | Light Amplification by Stimulated Emission of Radiation |
| lb | - | Pound |
| LED | - | Light Emitting Diode |

| | | |
|---|---|---|
| LO | - | Laser Optimized |
| LSZH | - | Low Smoke Zero Halogen |
| m | - | Metre |
| $m^2$ | - | 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 |
| 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 |
| 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 |
| Qty | - | Quantity |
| RCDD® | - | Registered Communications Distribution Designer |
| RF | - | Radio Frequency |
| RFI | - | Radio Frequency Interference |
| RJ | - | Registered Jack |
| rms | - | Root Mean Square |
| RU | - | Rack Unit (1.75”) |
| RX | - | Receive |

| | | |
|---|---|---|
| RX | - | Receiver |
| SAN | - | Storage Access Network |
| SC | - | Single Fibre Coupling Optical Fibre Connector |
| SCC | - | Standards Council of Canada |
| SCS | - | Structured Cabling 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 |
| TGB | - | Telecommunications Grounding Busbar |
| TGR | - | Telecommunications Grounding Rod |
| TIA | - | Telecommunications Industry Association |
| TMGB | - | Telecommunications Main Grounding Busbar |
| TP | - | Twisted Pair |
| TR | - | Telecommunications Room |
| TS | - | Technical Standard |
| TSB | - | Telecommunications Systems Bulletin (formerly Technical Systems Bulletin) |
| TTY | - | Teletypewriter / Text Telephone |
| TV | - | Television |
| TX | - | Transmit |
| TX | - | Transmitter |
| 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

1. General

1.1. CODES, STANDARDS AND REGULATIONS COMPLIANCES

1.1.1. Adhere to the latest edition of all applicable Codes, Standards, Regulations and documents listed throughout this document.

1.1.2. All products installed must meet or exceed all Local, Provincial and Federal Building, Fire, Health, Safety and Electrical Codes.

1.1.3. Non-plenum and plenum rated cables shall be ETL or ULC (UL) Listed and CSA Certified as type CMR / CMP (respectively).

1.1.4. 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 the table below. In the case of conflict or discrepancy the more stringent code, standard or regulation shall apply.

| **STANDARD** | **TITLE** |
|---|---|
| ***ANSI/ICEA*** | |
| S-80-576 | Standard for Category 1 & 2 Individually Unshielded Twisted Pair Indoor Cables (With or Without an Overall Shield) for Use in Communications Wiring Systems Technical Requirements |
| ***TIA/EIA*** | |
| 455 | Optical Fibre Test Procedures. |
| 568-C.1 | Commercial Building Telecommunications Cabling Standard: General Requirements. |
| 568-C.2 | Commercial Building Telecommunications Cabling Standard: Balanced Twisted Pair Cabling. |
| 568-C.3 | Commercial Building Telecommunications Cabling Standard: Optical Fibre Cabling Components Standard. |
| 569-B | Commercial Building Standards for Telecommunications Pathways and Spaces. Including Addenda 1-6. |
| 606-B | Administration Standard for the Telecommunications Infrastructure of Commercial Buildings. |
| 607 | Commercial Building Grounding and Bonding Requirements for Telecommunications. |
| RS232C | Interface between Data Terminal Equipment and Data Communications Equipment Employing Serial Binary Data Interchange |
| RS485 | Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multi-Point Systems |
| ***CSA*** | |
| C22.1-12 | Canadian Electrical Code Part I: Safety Standards for Electrical Installations. |
| CAN/CSA-C22.2 NO. 182.4-M90 | Plugs, Receptacles, and Connectors for Communication Systems. |
| C22.2 NO. 214-08 | Communications Cables. |
| C22.2 NO. 0.1-M1985 | Canadian Electric Code Part II: General Requirements for Double-Insulated Equipment |
| C22.2 NO. 232-09 | Canadian Electric Code Part II: Optical Fibre Cables. |

| | |
|---|---|
| C22.2 NO. 205-12 | Signal Equipment |
| 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 | Building Facilities, Design Guidelines for Telecommunications. |
| ***NFPA*** | |
| NFPA70 | NFPA70 – National Electrical Code |
| | |
| ***OTHER*** | |
| CAN/ULC-S115-05 | 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-S102-10 | Standard Method of Testing for Surface Burning Characteristics of Building Materials and Assemblies. |
| CAN/ULC S316-14 | Standards for Performance of Video Surveillance Systems |
| CAN/ULC S319-05 | Electronic Access Control Systems |
| UL 294 | The Standard of Safety for Access Control System Units |
| UL 365 | Police Station Connected Burglar Alarm Units and Systems |
| ULC1076 | Proprietary Burglar Alarm Units and Systems |
| UL 609 | The Standard of Safety for Local Burglar Alarm Units and Systems |
| UL 639 | Standard for Intrusion-Detection Units |
| UL 1610 | Standard for Central-Station Burglar-Alarm Units |
| ULC-S306-03 | The Standard of Safety for Intrusion Detection Units |
| UL 969 | Standard for Marking and Labeling Systems |
| UL 1037 | Standard for Antitheft Alarms and Devices |
| UL 1067 | Standard for Electrically Conductive Equipment and Materials for Use in Flammable Anesthetizing Locations |
| UL 1492 | Standard for Audio-Video Products and Accessories |
| UL 2044 | Standard for Commercial Closed-Circuit Television Equipment |
| CEC, Part 1 | The Canadian Electrical Code, Part 1. |
| CSA ISO/IEC 11801 | Information Technology: Generic Cabling for Customer Premises |
| ICEA S-80-576 | Individually Unshielded Twisted Pair Indoor Cable for Use in Communications Wiring Systems. |
| IEEE Std 1100 | IEEE Recommended Practice for Powering and Grounding Electronic Equipment (IEEE Emerald Book). |
| IEC 603-7, Part 7 | Detailed Specifications for Connectors, 8-Way, Including Fixed and Free Connectors with Common Mating Schemes. |
| ISO/IEC IS 11801A | Generic Cabling for Customer Premises. |
| WC 63.1 | Performance Standard for Field Testing of Unshielded Twisted-Pair Cabling System. |
| | |
| OHSA | Occupational Health and Safety Act - R.S.O. 1990, c. 0-1. |
| | |

| | |
|---|---|
| UL 444 and 13 | Adopted Test and Follow-Up Service Requirements For The Optional Qualification of 100Ω Twisted-Pair. |
| CCTA | Canadian Cable Television Association |
| NCTA-02/89 rev. 93 | NCTA Recommended Practices for Measurements on Cable Television Systems. |
| Industry Canada | ICES 003 Emissions |
| RoHs | |
| Subpart B | RF Emissions |
| CE Standards | EN 55022 RF Emissions |
| CE Standards | EN 55024 RF Immunity |
| FCC | Federal Communications Commission |
| FCC Part 15 | Radio Frequency Device |
| FCC Part 68 | Connection of Terminal Equipment to the Telephone Network |
| CE Standards | EN 60950-1 Equipment Safety |
| Provincial | |
| Ontario | |
| OESC | Ontario Electrical Safety Code – latest edition. |
| O.R. 388/97 | Ontario Fire Code – latest edition. |
| O.R. 403/97 | Ontario Building Code – latest edition. |
| Alberta | |
| AEUC | Alberta Electrical Utility Code |
| | Alberta Building Code |
| Quebec | |
| | Canadian Electrical Code, – latest edition with Québec amendments |
| British Columbia | |
| | British Columbia Building Code |
| | British Columbia Fire Code |
| | City Of Vancouver Building By-Law |
| Nova Scotia | |
| | Nova Scotia Electrical Installation and Inspection Act |
| | Nova Scotia Building Code Act |
| Manitoba | |
| | Manitoba Electrical Code |
| | Manitoba Fire Code |
| | |
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1.1.5. Comply with applicable Electrical Safety Code, all Local, Provincial and Federal 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.

2. Products

2.1. NOT USED

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. Particular attention shall be given to 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 Electronic Safety and Security Engineer's Representative will determine neatness of the installation. Cables that have not been properly combed and dressed shall be re-dressed at no extra cost. Co-ordinate with the Electronic Safety and Security Engineer's Representative prior to termination in any Telecom Rooms.

3.1.2. The maximum horizontal run length shall not exceed the equipment manufacturer's specifications. If the constraint cannot be met, notify the Electronic Safety and Security Engineer's Representative of any cables that exceed the equipment manufacturer's stated limitations. Include for rectification of the limitation in their bid. Rectifications shall include but not limited to active and passive devices, signal boosters, signal extenders, protocol converts, installation of wire gauge suitable to the cabling length being installed and/or a combination of the aforementioned.

END OF SECTION

1. General

1.1. SUBMITTALS – DRAWING DOCUMENTATION AND CABLE TEST RESULTS

1.1.1. Clearly mark all changes and deviations on construction drawing(s) during the construction process, include all conduit and cable pathways to and from equipment. 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 Electronic Safety and Security Engineer's Representative 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, forward to the Electronic Safety and Security Engineer's Representative two sets of drawings indicating all such changes and deviations for review within 5 business days of the completion of the project.

1.1.2. Supply (temporary hand-marked) as-built drawings to Electronic Safety and Security Engineer's Representative for The Region use 3 days prior to cut-over.

1.1.3. Request (via email) from the Electronic Safety and Security Engineer's Representative soft copy of drawings for use in preparation for Record Drawings.

1.1.4. All changes to drawing(s) shall be Engineering Draft Standards.

1.1.5. Return record drawing(s) on Flash Drives using AutoCAD R2000 or better. If this requirement cannot be met, Smith + Andersen will update all hand drawn Record Drawings to AutoCAD. The cost for this service shall be based on Smith + Andersen's per diem rates at time of completion. Pay for all costs associated with this work.

1.1.6. Print / plot **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 Smith + Andersen for final review and delivery to the Region.

1.1.7. The project will remain incomplete and a holdback will be retained until satisfactory as-built drawing(s) are provided.

1.2. SUBMITTALS – TESTING AND COMMISSIONING

1.2.1. Provide testing and commissioning documentation in soft and printed format for all items and their related components to the Electronic Safety and Security Engineer's Representative prior to the completion of the project or at the Electronic Safety and Security Engineer's Representatives request. Include maintenance manuals and operating instructions for The Region's staff use.

1.3. PERMITS, LICENSE REVIEWS AND FEES

1.3.1. Where materials are specified which require special review and approval of CSA and/or local authorities obtain such approval for the particular installation with the co-operation of the material supplier. Obtain and pay for permits and review required for work performed.

1.3.2. Submit required Documents and shop drawings to authorities having jurisdiction in order to obtain approval for the work. Prepare any additional information, details and drawings that these authorities may require.

1.4. ALTERNATE PRODUCT

1.4.1. This document specifies the use of complete end to end Electronic Safety and Security Systems as manufactured, warranted and certified by a single manufacturer. Alternate materials (from the overall system) will not be accepted unless specifically noted.

1.4.2. Where supply of the materials would compromise the schedule, submit a request to use alternate product to the Electronic Safety and Security Engineer's Representative. Depending on the circumstance, the Electronic Safety and Security Engineer's Representative may provide written authorisation to substitute the Product. Written authorisation shall be obtained before alternatives are purchased or installed.

1.5. SCHEDULING

1.5.1. Within one week of award of the contract submit a formal project schedule to the Electronic Safety and Security Engineer's Representative showing start and finish dates of major tasks as denoted by System, material order and delivery to site, installation, testing and commissioning.

1.5.2. Updated schedules shall be submitted as periodically requested by Electronic Safety and Security Engineer's Representative.

1.6. PROJECT MANAGEMENT

1.6.1. Provide complete project management for this project. Complete project management shall include but not limited to:

.1 Develop detailed Gantt Chart project plan and submit to The Region and Electronic Safety and Security Engineer's Representative for review and approval prior to start of project.

.2 Chair biweekly construction meetings for the duration of the project. Construction meetings shall be on site or via conference call at the Region's and or Electronic Safety and Security Engineer's Representative's discretion.

.3 Generate and submit detailed biweekly construction progress reports to The Region and Electronic Safety and Security Engineer's Representative. Each progress report shall include itemized detailed description and extent of tasks completed, itemized detailed description and quantification of materials installed and labeled photos that clearly show the extent of construction progress.

1.7. CLEANUP

1.7.1. Keep the site and surrounding area clean, safe and free from debris at all times. Remove all debris from the site on a daily basis.

1.7.2. Upon completion of the work and before acceptance and final payment will be made, remove 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.

1.8. ACCEPTANCE

1.8.1. Before acceptance by the Electronic Safety and Security Engineer's Representative, all the equipment and cabling must be installed, cleaned, tested commissioned. At points of

termination, all cabling and terminations must be free of any cable pulling lubricants before acceptance by the Electronic Safety and Security Engineer's Representative.

1.9. REVIEW AND TESTING REQUIREMENTS

1.9.1. Develop a testing and commissioning checklist for each system and submit to the Electronic Safety and Security Engineer's Representative for approval 10 business days before commissioning commences.

1.9.2. The Electronic Safety and Security Engineer's Representative must approve the testing and commissioning procedure prior to the commencement of testing and commissioning and may request to be present.

1.9.3. Local testing to be performed at the facility. Following successful demonstration of local testing, operational testing to be performed utilizing Region's existing Honeywell EBI Server.

1.9.4. Local testing to be performed at the facility. Following successful demonstration of local testing, operational testing to be performed utilizing Region's existing Honeywell EBI Server.

1.9.5. Following successful integration with Honeywell EBI Server, shift programming of the facility, if applicable, to be coordinated through the Region's Security and Life Safety Coordinator (905) 830-4444 ext.6900.

1.9.6. The Electronic Safety and Security Engineer's Representative shall be invited to witness field testing and commissioning, and shall be notified of the start date of the testing phase 10 business days before testing and commissioning commences.

1.9.7. Test and commission all electronic safety and security systems.

2. Products

2.1. NOT USED

3. Execution

3.1. INSTALLATION

3.1.1. NOT USED

END OF SECTION

# 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 Code Requirements.

.3 Moisture seals as well as fire and smoke seals shall be required for all floor penetrations.

.4 Establish and or re-establish the integrity of all fire-rated structures and assemblies that they have created or disturbed.

.5 Supply and install Fire Stop pillows for existing cable tray penetrations through firewalls.

.6 For the purposes of this specification, the only acceptable Fire Stop Systems shall be those that have been tested to the applicable ULC Standards.

.7 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).

.8 All fire stopping shall maintain a minimum one hour rating and shall meet applicable Federal, Provincial and Local building codes.

.9 All Fire Stop Systems shall be listed and tested by an SCC and accredited Third Party Testing Agency in accordance with the Standards.

.10 Fire resistance ratings of installed Fire Stop Systems shall not be less than the fire resistance rating of the surrounding Fire Separation or Firewall.

.11 All Smoke Seals selected for use shall comply with Standards.

.12 Where moisture seals are required for floor penetrations in Operating Rooms, Morgues, and Laboratories in Hospitals, Universities and Schools, the Fire Stop Materials selected shall be compatible with Formalin.

.13 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. Water Proofing

.1 Seal all foundation penetrating conduits and service entrance conduits and sleeves to eliminate the intrusion of moisture and gases into the building. This requirement also includes spare conduits.

.2 All service entrance conduits through building shall be sealed or resealed upon cable placement. Spare conduits shall be plugged with expandable plugs.

### 1.1.3. Quality Assurance

.1 Provide fire stopping systems that comply with the following requirements following:

.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 Codes.

.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.

1.1.4. 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.

1.1.5. 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 approved equivalent) are acceptable.

2.2.2. Obtain fire stop systems for each type of penetration and construction condition indicated only from a single manufacturer.

2.3. MATERIALS

2.3.1. Firestop Sealants: The following products are acceptable.

.1 Hilti FS-ONE 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

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

2.3.3. Firestop Putty: An intumescent, non-hardening, firestop putty for cable and pipe penetrations. The following product is acceptable:

.1 Hilti CP 681 Firestop Putty Stick.

2.3.4. Firestop Plug: Ready-to-use intumescent and reusable plug for small openings. The following product is acceptable:

.1 Hilti CP 658T Firestop Plug.

2.3.5. Fire Rated Cable Pathways: Re-penetrable cable management device:

.1 Hilti CP 653 Speed Sleeve.

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 Fire Stop Material voids. Fill and or correct Fire Stop Materials to eliminate voids.

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. 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 document.

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. WATER PROOFING

3.2.1. Conduits with cables in them shall be permanently sealed by firmly packing the void around the cable with oakum and capping with a hydraulic cement or water proof duct seal.

3.3. EXPOSED SERVICE PENETRATIONS IN CEILING OF UNDERGROUND PARKING AREAS

3.3.1. Where the bottom of a Fire Stop System is exposed, seal bottom side of the assembly with a fire rated elastomeric Fire Stop sealant.

3.4. CLEAN UP

3.4.1. Remove excess materials and debris and clean adjacent surfaces immediately after application to satisfaction of Project Manager. Remove and or correct staining and discolouring of adjacent surfaces as directed.

END OF SECTION

1. General

1.1. TRAINING

1.1.1. Include for adequate training of minimum 4 operations personnel on the operation and maintenance of the Electronic safety and Security Systems. The training shall be minimum eight (8) hours of instruction in two (2) 4-hour segments.

1.1.2. Coordinate with the Region and configure and or reconfigure and populate and or repopulate all Electronic Safety and Security system related databases, configure and or reconfigure all the systems parameters to the Regions' satisfaction and or until initialed databases are complete and functional and or until all the security system parameters are working to the Region's satisfaction. Provide one technician to work side-by-side with the Region's representatives to assist and instruct the Region's representatives with further customization of all systems functionalities to the Region's satisfaction.

1.1.3. The training shall include but not limited to oral and written presentations and onsite system interactive training sessions that ensure operational competency of operations personnel on each Electronic Safety and Security system.

.1 Provide 6 full sets of maintenance manuals and operating instructions. This shall include comprehensive descriptive data sheets, brochures and technical manuals for all systems and equipment forming part of the contract. The manuals shall include wiring and schematic diagrams for the IESSS and all related subsystems.

.2 For each Electronic Safety and Security subsystem, Provide and A4 laminated sheet with short form operating instructions on one side, and a site diagram showing systems components on the other.

.3 Submit a full schedule of maintenance that shall be carried out on each Electronic Safety and Security system during the warranty period and under subsequent maintenance contracts.

1.1.4. Training shall cover all aspects of all the systems under the electronic safety and security scope.

1.1.5. All training sessions shall be provided on minimum 4 Flash Drives for later use by The Region.

2. Products

2.1. NOT USED

3. Execution

3.1. NOT USED

END OF SECTION

1. General

1.1. NOT USED

1.2. FLOOR/CEILING TILES

1.2.1. Allow for the removal and re-installation of all floor/ceiling tiles in areas affected by their work. This shall be done on a daily basis for all areas that are occupied during the construction period. Otherwise remove and re-install the tiles after their work is complete.

1.2.2. Replace all soiled and or damaged ceiling tiles during the installation of any work described in this document. Damages include chipping, breaking or fingerprints. Final decisions on the trade responsible for any damage to ceiling tiles shall be made by the Project Manager and/or the Electronic Safety and Security Engineer's Representative.

1.2.3. Store and protect all floor/ceiling tiles when they have been removed from the floor/ceiling grid.

1.3. SAFETY OF PERSONS AND PROPERTY

1.3.1. Comply 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.

1.3.2. 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.

1.3.3. 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.

1.3.4. No open flames/smoking shall be permitted without prior written approval of the Region.

1.3.5. Set up and remove of all signage and safety measures to ensure that other trades and non-trade personnel are safe from all work being performed.

1.4. ACCESS TO SITE

1.4.1. Coordinate site access with the General Contractor and/or The Region as determined during the initial project meeting.

1.5. IDENTIFICATION

1.5.1. All personnel shall be clearly identified by either uniform or company ID. In addition, wear The Region provided ID for required card access locations or identification. All The Region ID must be returned daily or at the end of the project as determined by the Region.

1.6. EMERGENCY FACILITIES

1.6.1. Maintain 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.

1.7. PRODUCT DELIVERY REQUIREMENTS

1.7.1. Allow for complete delivery, handling, and installation of all materials used in the performance of the work.

1.7.2. Arrange for the delivery of The Region furnished equipment/materials related to this Specification and related items, including unloading of supplier's truck, elevator scheduling and placement on The Region premises as indicated on Contract drawings.

1.8. PRODUCT AND TOOLS STORAGE REQUIREMENTS

1.8.1. Allow for complete storage and handling of all materials used in the performance of the work.

1.8.2. Storage of job boxes on the site during construction may be allowed by The Region. Coordinate the storage of job boxes onsite with The Region. The Region and his representatives shall be in no way responsible or liable for any stored tools and or materials.

1.9. CONFINED SPACES

1.9.1. Comply with all code related and The Region specific safety requirements when performing work in a confined space.

1.10. CO-ORDINATION WITH OCCUPANTS

1.10.1. Coordinate all work with the Region/tenant of the floor space for their daily work.

1.11. PROJECT MEETINGS

1.11.1. Attend site meetings when requested by the Electronic Safety and Security Engineer's Representative and/or the Project Manager. Regular meetings may occur once per week at the Electronic Safety and Security Engineer's Representative's and/or the Project Manager's discretion.

1.11.2. 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.

1.11.3. PROGRESS REPORTS

1.11.4. Issue 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 USED

3. Execution

3.1. PRODUCT DELIVERY REQUIREMENTS

3.1.1. Unload 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. Assemble the above equipment/materials and protect the above equipment and related items until project cut over. Replace all damaged equipment at no extra charge.

END OF SECTION

1. General

1.1. NOT USED

2. Products

2.1. RECORD DRAWINGS

2.1.1. Request in writing from the Engineer's Representative all Contract Drawings in AutoCAD format required to complete the Record Drawings. Complete attached form and pay the Engineer's Representative directly the costs identified within the form prior to receiving the Contract Drawings. After the final Record Drawings have been reviewed, provide multiple copies of the drawings on a Flash Drive. One copy is to be returned to the Engineer's Representative for their records and a minimum of one copy with each set of operation and maintenance manuals. Provide additional copies if required under the General Conditions. Use latest release of AutoCAD software.

2.1.2. The Record Drawings shall include but not limited to:

.1 AutoCAD and .pdf copies of Site and Floor Plans indicating locations of all devices

.2 AutoCAD and .pdf copies of Point –to-point wiring schematics of all systems and subsystems

.3 AutoCAD and .pdf copies of Elevations of all rack, cabinets and backboard showing details device mounting

.4 MS Word/Excel and .pdf copies of All related schedules

.5 MS Word/Excel and .pdf copies of Testing and commissioning documentation for all devices

2.1.3. Identify the cost of Record Drawings and the Operation and Maintenance Manuals as a separate line item on progress draw. The following values are to be broken out:

| | |
|---|---|
| $3,500 | For Contracts up to $250,000 |
| 2% of Contract | For Contracts from $250,000 to $1,500,000 |

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.

2.1.4. Final Record Drawings prints/plots shall not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.). References to the Architect and Engineer must be deleted from the drawings.

2.1.5. Final Record Drawings shall include all revisions made to the drawings during construction, including all approved change. The Record Drawings shall also include the routing of all feeders except for branch circuits. Include slab layout drawings in as-built drawing package.

2.1.6. CADD Requirements:

.1 All AutoCAD Record Drawings shall be prepared using the Region's CAD standards. Obtain the Region's CAD standards from the Region prior to preparing Record Drawings.

.2 A complete list of layer names and brief description of each layer's use shall accompany all files.

.3 Fonts for text shall be AutoCAD standard. Custom fonts, shape files, etc., are not to be used.

.4 Final Record Drawings drawings shall be returned on a Flash Drive.

.5 Each CD ROM shall be clearly labelled with Engineer's Representative 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 Flash Drive. A printed copy of the readme file shall accompany each Flash Drive.

.6 All drawings shall be in the same units as issued on Bid Documents.

.7 Provide a complete list of symbol (block) names with a description of each symbol.

.8 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.

2.1.7. Maintain two sets of white prints on site on which clearly mark, as the job progresses, all changes and deviations from that shown on Contract Drawings.

2.1.8. On completion of the building, forward to the Engineer's Representative the two sets of final drawings indicating all such changes and deviations for review by the Engineer's Representative.

3. Execution

3.1. NOT USED

END OF SECTION

PROJECT NAME: Xxx

ATTENTION: Xxx

PROJECT NO.: Xxx DATE: YYYY-MM-DD ISSUED BY: Xxx

## Conditions for Limited Use of CAD Drawings

Authorization for limited use of the Computer-Aided Drafting (CAD) drawing files listed below is hereby granted, subject to the following conditions. Signing of this form constitutes acceptance and agreement with the conditions and limitations.

Copyright is reserved. The drawing and design contained in the CAD drawing file is at all times the exclusive property of the Architect/Engineer and shall not be used without the Architect/Engineer's written consent.

The CAD drawing file may not be used wholly or in part for any purpose other than the intended use as stated on this form. Copying or distribution of this CAD drawing file in whole or in part to parties other than those signing below is not allowed.

The CAD file represents drawings which were prepared primarily for the purpose of obtaining tender prices. The drawings may or may not incorporate subsequent revisions, change orders, or addenda which have modified the drawings. CAD files obtained from different disciplines may not be fully updated and coordinated with other disciplines and must be verified from the tender documents. The Architect/Engineer assumes no liability for errors or omissions in the CAD drawing files. Authorized user assumes all risk and expense associated with the use of the drawing files in the production of his work.

References to the Architect and Engineer must be deleted from the drawings.

Please indicate a P.O. Number for charges associated with administrative costs to provide requested AutoCAD drawings.

| | | | | |
|---|---|---|---|---|
| Our charges are as follows: | $50.00 each for the first 5 drawings | | | |
| | $20.00 for each additional drawing from 6 to 19 | | | |
| | $500.00 for 20 drawings or more | | | |
| List of requested drawings: | | | | |
| Total No. of Drawings: | | Total Charge: | | + GST or HST, as applicable |

_____
Intended use (Shop drawings, As-built drawings, Installation and Interference drawings, etc.)

_____
CD ROM disc (please provide delivery address)

_____
E-mail (please provide e-mail address)

A cheque in the above amount shall be payable to **Smith + Andersen**.

Please sign and fax back this form to Smith + Andersen (416-487-9104) acknowledging the above charges and Conditions for Limited Use of CAD Drawings.

**Accepted by:**

| | |
|---|---|
| **Signature** | **Name (print or type)** |
| **Company Name** | **P.O. #** |
| **Company Address** | **Phone #** |

c.c. Accounting ; (Project Principal) – Smith + Andersen

1. General

1.1. NOT USED

2. Products

2.1. SUBMITTALS/SHOP DRAWINGS

2.1.1. 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. B-P2-AAA).

2.1.2. All shop drawings shall identify the specific model number of equipment being supplied.

2.1.3. Each Shop Drawing for non-catalogue items shall be prepared specifically for this project. Shop Drawings data sheets and brochures for catalogue items shall be marked clearly to show the items being supplied.

2.1.4. Each Shop Drawing or catalogue sheet shall be stamped and signed to indicate that he has checked the drawing for conformance with all requirements of the drawings and specifications, that he 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 all electrical, mechanical and architecture co-ordination are complete before submitting drawings for review.

2.1.5. Submit all submittals/shop drawings electronically in PDF format. Submittal shall be complete with a transmittal bound to the PDF file with the transmittal identifying the total number of pages in the submittal including the transmittal page.

2.1.6. Shop Drawings shall include but not limited to:

.1 Catalogue data sheets for each product that will be provided

.2 Detailed schematic riser drawings clearly indicating the physical and logical connectivity of each system and how each product will be implemented in the physical and logical connectivity of each system with interconnection diagrams.

.3 An itemized shop drawing index with a summery list of items being submitted for review. The list shall indicate Item Number, Item Manufacture and Model Number and Item name and a Review Comments Column.

.4 All additional requested information as determined by the Engineer’s Representative

2.1.7. Installation of any equipment shall not start until after the Engineer’s Representative has reviewed Shop Drawings.

2.1.8. When requested, Shop Drawings shall be supplemented by data explaining the theory of operation

2.1.9. Provide space for Shop Drawing review stamps for Engineer’s Representative. This space shall be clear of all technical information and shall not be on the back of any sheets.

2.1.10. One original Shop Drawing will be returned either hard copy or electronically.

3. Execution

3.1. NOT USED

END OF SECTION

# 1. General

## 1.1. WORK INCLUDED

1.1.1. Supply and install conductors and cables as detailed in Contract Documents and as required and as recommended by the manufacturer to ensure proper operation of all devices and systems. Use pathways (by Division 26) to distribute the cables throughout the facility. Where the cables leave the pathways and extend to the termination point supply and install conduit as needed to support and secure the cables.

1.1.2. Where pathways are not provided by Division 26 provide pathways for all Electronic Safety and Security Systems conductors and cables.

1.1.3. All Electronic Safety and Security Systems conductors and cables shall be installed in pathways as shown on contract drawings.

1.1.4. Pathways shall include but not limited to conduit, cable trays and cable troughs.

1.1.5. Avoid scraping, denting, or otherwise damaging cables, before, during or after installation. Without any additional compensation replace damaged cables.

1.1.6. Ensure that all cable lengths are sufficient to allow for slack, vertical runs, wastage, connectorization and future moves.

1.1.7. Make any necessary changes or additions to routing of cables and pathways to accommodate structural, mechanical, electrical and architectural conditions. Where pathways or cables are shown diagrammatically install them in straight lines making 90 degree turns parallel to building grid lines. If it is necessary to run cables otherwise to accommodate acceptable cable lengths, written permission must be obtained from the Engineer’s Representative prior to installation.

## 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 grid lines. If it is necessary to run cables otherwise to accommodate acceptable cable lengths, written permission must be obtained from the Electronic Safety and Security Engineer’s Representative prior to installation.

# 2. Products

## 2.1. CABLING

2.1.1. Conductors and cables shall be CMR where installed completely in conduit and/or where installed in non-plenum rated areas. Conductors and cables shall be CMP where not completely installed in conduit and/or installed in plenum rated areas. All cable shall conform to the recommendations of the manufacturers of the electronic safety and security systems.

2.1.2. Conductors and cables shall be outdoor rated where installed outdoor and /or installed in locations where they will be exposed to weather elements.

2.1.3. Conductors and cables shall be rated for the environment and or environments in which they are being installed.

2.1.4. Provide and install shielded cables where required and or recommended by the manufacturer of the electronic safety and security systems.

2.1.5. Cabling shown is for typical systems. All cabling shall be as required and recommended by the manufacture of the electronic safety and security systems.

2.1.6. Provide all RS-232, RS-485, Optical Fibre and Ethernet cabling, and Fibre and Ethernet jacks as required for a complete network, if applicable.

2.1.7. All wiring shall be of proper gauge, type and quantity of conductors as required and as recommended by the manufacturer to ensure proper operation of electronic safety and security systems and peripheral devices. Provide

2.1.8. Multi-conductor cables shall have the conductors color coded.

2.1.9. All conductors and cables shall be CSA approved and shall be stamped accordingly.

2.1.10. Conductors and cables for Card Readers

.1 Minimum 3 pair, AWG 22, over all shielded or as required based on distance from controller

2.1.11. Conductors and cables for door contact

.1 Belden minimum 4 conductor, AWG 22 or as required based on distance from controller

2.1.12. Conductors and cables for electric strikes, magnetic locks, electric latches, electric mortise locks and all other electrified locks

.1 Belden minimum 4 conductor, AWG 18 or as required based on distance from power source

2.1.13. Conductors and cables for motion request to exit devices

.1 Belden minimum 6 conductor, AWG 22 as required based on distance from controller

2.1.14. Conductors and cables for push button and latch bolt monitor request to exit devices

.1 Belden minimum conductor, AWG 22 as required based on distance from controller

2.1.15. Conductors for RS-485 cables

.1 Twisted pair, each conductor No. 22 AWG stranded copper.

.2 Pairs: 2.

.3 Sheild: Aluminum-polyester and 90% copper tinned braid.

.4 Jacket: Black UV resistant PVC.

.5 Electrical Characteristics at 20oC

.6 Capacitance: 36.1 pF/m

.7 Impedance: 120 ohms

.8 Propagation Velocity: 78%

.9 Belden Datalene Insulated 3107A.

2.1.16. Conductors for Serial Cables

.1 Belden #9945

.2 #22AWG.

.3 7-stranded copper.

.4 Overall Beldfoil aluminium polyester shield plus 65% minimum tinned copper braid shield.

.5 9 conductors. Select Belden trade number to suit number of conductors required for the specific application – Belden #99xx.

.6 EIA RS-232 applications.

2.1.17. Conductors and cables for IP CCTV Camera

.1 Conform with the following plenum rated Ethernet 100BASE-T TIA/EIA 568-B.2-1 Category 06 cable:

.2 CSA Certified for trays and risers.

.3 Conductors: Unshielded twisted pair, #23 AWG solid copper.

.4 Pairs: 4

.5 Jacket: Blue Flamearrest, CSA FT4/FT6 rating.

.6 Certification/Testing to Category 06 in accordance with the current TIA/ISO Channel Standards.

.7 Belden #2400.

2.1.18. Increase conductor quantities and or sizes beyond the above stated minimums as required to facilitate proper and complete operation of each respective device and systems.

3. Execution

3.1. CABLE DISTRIBUTION

3.1.1. Where cables are not installed in conduit neatly bundle and tie-wrap all cables using Velcro tie-wraps.

3.1.2. Follow proper installation and termination practices for all cables. Do not kink or exceed the cable minimum bend radius. Maintain a minimum of four (4) times cable diameter as bend radii if the manufacturer specifies no bend radius.

3.1.3. 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. CONDUCTORS AND CABLES

3.2.1. Supply and install all wiring as required for the proper operating of each electronic safety and security system and each peripheral device.

3.2.2. Provide and install metal wiring duct to facilitate proper organization and proper dressing of all cables at and around each electronic safety and security system panel.

3.2.3. Supply and install metal wiring duct from conduit end points to and around all control panels.

3.2.4. All wiring ducts shall be installed such that the ducts house, protect and facilitate the routing of all cables at 90 degree angles to and around all access control panels.

3.2.5. Provide non-metallic wiring ducts within all control panels to manage all wiring to termination points.

3.2.6. All wiring duct shall be sized to house all cables while maintain manufactures recommended bend radius.

3.2.7. Provide all fitting for all wiring duct as required, including but not limited to; couplings, end caps, brackets, etc.

3.2.8. After installation, and before termination, all wiring and cabling shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors or shields. A V.O.M. shall be utilized to accomplish these tests and a reading of greater than 20 Megohms shall be required to successfully complete the test.

3.2.9. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination.

3.2.10. Protect wire and cable from kinks.

3.2.11. Provide grommets and strain relief where required.

3.2.12. Comply with controller and peripheral device manufactures installation and termination recommendation.

END OF SECTION

# 1. General

## 1.1. WORK INCLUDED

1.1.1. This document describes the products and execution requirements relating to supplying and installing Grounding and Bonding for Electronic Safety and Security Systems.

1.1.2. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labelled, and documented as detailed in this document.

1.1.3. Product specifications, general design considerations, and installation guidelines are provided in this document.

1.1.4. Meet or exceed all requirements for the grounding system described in this document.

## 1.2. GENERAL REQUIREMENTS

1.2.1. Adhered to all applicable codes and standards.

1.2.2. Any metallic component that is part of an Electronic Safety and Security Room including equipment, racks, cabinets, ladder racks, enclosures, cable trays, duct work, etc. shall be bonded to the grounding system.

## 1.3. ELECTRONIC SAFETY AND SECURITY BONDING BACKBONE REQUIREMENTS

1.3.1. The Grounding Busbar (GB) in each Electronic Safety and Security space shall be grounded to the Building Ground Riser by Division 26. The GB and its Bonding Backbone (BB) shall be supplied and installed by Division 26.

# 2. Products

## 2.1. EQUIVALENT PRODUCTS

2.1.1. All grounding and bonding products required shall meet the requirements of this section and the applicable codes and standards of CSA C22.2 No. 41 – Grounding and Bonding of Equipment, latest edition.

## 2.1 CONDUCTORS

2.1.1 Bare or insulated, stranded, soft drawn annealed copper wire, for: ground bus, electrode interconnections, metal structures, ground connections, telephone ground.

## 2.2 LUGS

2.2.1 All grounding connections to be made with compression type fittings and lugs with inspection / viewing window.

## 2.3 ELECTRONIC SAFETY AND SECURITY GROUNDING BUSBAR

2.3.1 The Grounding Busbar (GB) shall be supplied and installed by Division 26. Use compression lugs with window when connecting conductors to the GB.

3. Execution

3.1. GENERAL

3.1.1. Ground and or Bond all metal components of the Electronic Safety and Security Systems to all applicable codes and standards.

END OF SECTION

1. General

1.1. WORK INCLUDED

1.1.1. Supply and install cabling as detailed in Contract Documents. Provide all required pathways to distribute the cables throughout the facility where conduit is not provided by Div 26. Where cables leave the pathways, Supply and install cable slings and/or j-hooks to support cabling up to point of termination.

1.2. CABLE DISTRIBUTION

1.2.1. Utilise all indicated and available cable pathways such as conduits, Communications cable tray, ducts, surface raceways and furniture system channels except where otherwise noted.

1.2.2. Inside buildings minimize any possibilities of disruption 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 | --- | 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.) | 152 mm (6”) | | |

2. Products

2.1. NON-CONTINUOUS CABLE SUPPORT

2.1.1. Supply and install cable support for the distribution of horizontal and backbone cables where conduit or ladder tray has not been provided.

2.1.2. The size of J-hooks/support shall suit quantity of cables in runs used for distribution.

2.1.3. Include any other miscellaneous hardware (angled hanger bracket, hammer/screw on clamps) required to support horizontal and backbone cabling.

2.2. VELCRO TIE-WRAPS

2.2.1. Supply and install Velcro tie-wraps. Only Velcro tie-wraps shall be acceptable. Under no circumstance shall plastic tie-wraps be used.

2.3. GROUNDING WIRE

2.3.1. Supply and install #6 AWG green grounding wire for all metallic components that shall be grounded and Code Conductor Two Hole Long Barrel with Window Lug to bond the conductor to the GB.

3. Execution

3.1. CABLE DISTRIBUTION

3.1.1. 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.

3.1.2. All cables and components shall be installed and terminated in accordance with applicable Codes, Standards and Regulations.

3.2. CABLE SUPPORT

3.2.1. Hangers shall be installed at 1219mm (48") intervals (maximum). Cables shall be run such that sag between supports does not exceed 100 mm (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. Comb and redress any cables that are unsatisfactory at no additional cost.

3.2.2. Attaching to T-bar support rods is not acceptable. Anchors for hangers must not be drilled into post tensioned beams under any circumstances. Do not use Pneumatic hammers. All anchors must be drilled into slab.

3.2.3. Do not 'fire spray' insulation during installation of cable supports.

3.3. VELCRO TIE-WRAPS

3.3.1. Velcro tie-wraps shall be used to neatly dress cables; they shall be placed at a maximum of 1219 mm (48") intervals for horizontal distribution (centre points between cable supports).

3.3.2. Velcro tie-wraps shall also be used to dress cables into racks/cabinets. Maximum spacing of Velcro for cables into or along vertical cable managers shall be no more than 152 mm (6"), this includes cabling dropped from the ladder tray or ceiling above.

3.4. CABLE DISTRIBUTION

3.4.1. 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 Electronic Safety and Security Engineer's Representative, to prevent over tension on the cable.

3.4.2. Minimum bend radius shall be as per manufacturer's recommendations.

3.4.3. Make cable pulls continuous and steady between pull points. Do not interrupt the pull unless necessitated by excessive tension on the cable.

3.4.4. Protect exposed cable ends from moisture ingress.

3.5. DUCT AND CONDUIT

3.5.1. 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 Electronic Safety and Security Engineer's Representative of the problems encountered.

3.5.2. Apply manufacturer's recommended lubricant to cables to reduce friction between the cable and the conduit. 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

# 1. General

## 1.1. WORK INCLUDED

1.1.1. Provide A Class 3 system as per the latest version of the ANSI/TIA/EIA 606 Standards.

1.1.2. All elements of the Electronic Safety and Security Systems shall be labelled with unique identifiers.

1.1.3. Where labelling schemes are not provided co-develop a labelling scheme with the Region and the Electronic Safety and Security Engineer's Representative prior to the installation of any permanent labels on the Electronic Safety and Security Systems components.

1.1.4. Labelling schemes shall be confirmed with the Electronic Safety and Security Engineer's Representative prior to installation.

# 2. Products

## 2.1. LABELS

2.1.1. All cable and equipment labels shall meet the legibility, defacement, and adhesion requirements specified in ANSI/UL 969. In addition the labels shall meet the general exposure requirements in ANSI/UL 969 for indoor and outdoor 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 should be of sufficient length to wrap around the cable at least one and one-half times. The width shall be sufficient to accommodate the appropriate label designation.

2.1.3. All backbone and horizontal cables including patch cord labels shall be printed in 10 point Arial Narrow, black, bold font.

2.1.4. All equipment labels shall be printed in 14 point Arial Narrow, black, bold font.

2.1.5. All Hub, Main Cabinets and controlling device enclosure labels shall be shall be black lamacoid plates with white 60 point Arial Narrow, engraved upper case letters enclosed by white border on

2.1.6. Labels should be visible during the installation of and normal maintenance of the infrastructure. Labels should be resistant to the environmental conditions at the point of installation (such as moisture, heat or ultraviolet light) and should have a design life equal to or greater than that of the labelled component.

2.1.7. Provide vinyl substrate with a white printing area and black print. If cable jacket or equipment is white, provide cable label with printing area that is any other color than white, preferably orange or yellow – so that the labels are easily distinguishable.

2.1.8. Labels shall be flexible vinyl or other substrates to apply easy and flex as cables are bent. Labels shall use aggressive adhesives that stay attached even to the most difficult to adhere to jacketing.

2.1.9. All labels shall be mechanically printed using a laser printer. Hand-written labels are not permitted.

2.1.10. Wire and cable markers shall be Printable, self-laminating, self-adhesive markers, white background, black lettering on white background, vinyl plastic or polyester film suitable to environment. E-Z-Code by Thomas & Betts Ltd., or approved equivalent. Wire marker to be sleeved with clear heat shrink tubing.

2.1.11. Submit label samples Communication Engineer's Representative and The Region for approval prior to procurement and installation.

3. Execution

3.1. LABELLING

3.1.1. Supply and install all labels as indicated in this document and contract drawings.

3.1.2. Supply and install all labels for all cables and all active and passive devices, conduits and pull boxes.

3.1.3. All temporary labels shall be removed from cables and equipment prior to commissioning.

3.1.4. All labels must be mechanically printed using a laser printer. Hand-written labels are not permitted.

3.1.5. Label all ends of conduits including ends of conduits that terminate in pull boxes. Label shall be installed within 304mm (12") of each conduit end. Label designations for conduit and pull boxes shall be confirmed with consultant prior to procurements and installation. Allow for adding label designations (soft) for conduits and pull boxes to soft cabling schedules.

3.1.6. All backbone and horizontal cables including patch cord labels shall be printed in 10 point Arial Narrow, black, bold font.

3.1.7. All equipment labels shall be printed in 14 point Arial Narrow, black, bold font.

3.1.8. All Hub and Main Cabinets labels shall be shall be black lamacoid plates with white 60 point Arial Narrow ,engraved upper case letters enclosed by white border on

3.1.9. Submit sample labels to Communications Consultant for approval prior to procurement and instillation.

3.1.10. Labels shall be located on cables and equipment as indicated in this document and on contract drawings.

3.1.11. Labels shall be affixed to the front and rear of equipment where required and 150 mm (6") from the end of all backbone and horizontal cables.

3.1.12. Labels shall be affixed 75 mm (3") from the end of all patch cords.

3.1.13. All labels shall be visible.

3.1.14. All temporary labels shall be removed from cables and equipment prior to commissioning.

3.2. LABEL LOCATIONS

3.2.1. All labels shall be visible.

3.2.2. Labels should be attached at both ends of all cables (within 75 mm (3”) of end).

3.2.3. All active and passive equipment shall be labeled.

3.2.4. Labels shall be affixed to the front and rear of equipment where required and 150 mm (6”) from the end of all backbone and horizontal cables.

END OF SECTION 28 05 53.00

# 1. General

## 1.1. PURPOSE

1.1.1. The buildings and facilities Access Control System primary function is to protect the assets. The contents of this document are critical and are considered confidential. This information shall not be disclosed to anyone other than authorized personnel.

## 1.2. SCOPE OF WORK

1.2.1. The work covered by this section includes the furnishing, installation and activation of all equipment & materials associated with complete Access Control System as shown and as specified herein. This work may include, but is not limited to integration with the associated subsystems and components listed in these sections.

## 1.3. SYSTEM CONFIGURATION

1.3.1. An existing Honeywell EBI access control system is installed in the York Region building electrical rooms.

1.3.2. The new access control system and devices shall be an extension of and shall be integrated with the existing Honeywell EBI access control system.

1.3.3. Provide all software licences as required for a complete turnkey access control system.

Allow for configuration and programming of additional devices.

# 2. Products

## 2.1. GENERAL

2.1.1. All products and materials must be new and approved in the pre-installation submittals.

2.1.2. Exterior devices shall be sealed and protected against weather conditions including heat, cold, moisture, dust, and sand.

2.1.3. Commercial grade, high quality and rated for the environment in which it is being installed

2.1.4. Compatible with the access control system.

2.1.5. Include Back up UPS Pro to power all security, access control and wireless network solution. Model to be used is Antigen-presenting cell (“APC”) Pro BR 1300G or equivalent

## 2.2. NETWORK CONTROLLER

2.2.1. Honeywell Tema Server2 Control Panel: TS2 up to 16 doors using Weigand Interface Units(“WIU”) (each WIU shall be capable of managing one access controlled door with either 1 in reader or 1 in and 1 out reader at the door). Uses on board TCP/IP, 128MB DDR SRAM.

2.2.2. Include 6.5amp Electronic Security Devices SPS-6.5 Power Supply for Panel.

2.2.3. Include 5amp Electronic Security Devices SPS-5 for Lock power with Altronix ACM8 lock distribution w/Fire Interface.

2.2.4. Include Full Size Cabinet and cabinet tamper switch. Power Supply to be CSA and ULC listed

2.2.5. Include Back up UPS Pro to power all security, access control and wireless network solution. Model to be used is Antigen-presenting cell (“APC”) Pro BR 1300G or equivalent

2.3. INPUT/ OUTPUT MODULE

Input I/O Module A01, allows for 4 input/output per unit.

2.4. WEIGAND INTERFACE UNIT

2.4.1. Honeywell A08 Weigand Interface Unit, allows control of one door configured as either 1 in reader or 1 in reader and 1 out reader.

2.5. CREDENTIAL READERS - MULTITECHNOLOGY ICLASS READER

2.5.1. Card Readers: Provide multi-technology iClass / proximity card readers where shown on the Drawings and/or where required by the Contract. Card Readers shall be rated for indoor and outdoor use, have multicolour LED with beeper for operator status indications and will operate on 5-16 VDC. Provide thin line mullion style readers where required to match door frame configuration:

.1 Model RP15 Mullion Reader

.2 Model RP40 Switch plate Reader

.3 Model RPK40.

2.6. CREDENTIALS

2.6.1. The Region Provided.

2.7. PERIPHERAL DEVICES

2.7.1. Door Contacts (Steel)

.1 1” dia. contact for use in steel doors.

.2 Flush or surface mount as required

.3 Self-lock mounting

.4 Rugged Construction

.5 GE Security/Interlogix 1078, or approved equivalent

2.7.2. Request to Exit Detector

.1 Dual Technology

.2 Electrical

.1 Voltage: 12 to 30 VAC/VDC

.2 Current: 23 mA typical, 28 mA max. @ 12 VDC; 15mA typical, 17 mA max. @ 24 VDC; 31 mA typical, 38 mA max. at 12 VAC; 26 mA typical, 29 mA max.at 24 VAC

.3 Time delay: 1/2, 1, 2, 4, 8, 16, 32, 64 sec. at ± 10%,selectable

.4 Loop type: Open or Closed

.5 Max. loop rating: 2 A @ 30 VDC

.6 Alarm output: DPDT (Form C)

.7 Tamper output: 50 mA @ 30 VDC

.8 Wire gauge: AWG 14 to 22 (18 to 22 recommended)

.3 Features

.1 Radar frequency: 5.8 GHz

.2 Range, depth: 3 to 15 ft. (0.9 to 4.57 m) adjustable

.3 Range, width: 7.9 ft. (2.4 m)

.4 Range, PIR: 15 ft. (4.6 m), adjustable

.4 Environmental

.1 Operating temperature: -20 to 120°F (-29 to 50°C)

.2 Relative humidity: 0 to 95% noncondensing

.3 RFI immunity: 10 V/m @ 80 MHz to 2 GHz

.4 Static immunity: 10 kV

.5 Lightning immunity: 2.3 kV @ 1.4 J

.5 Physical

.1 Dimensions (HxWxD): 1.76 x 7.395 x 1.85 in. (45 x188 x 47 mm)

.2 .2 Weight: 9.2 oz. (261 g)

.3 .3 Housing material: ABS plastic

.4 Colors: White, black, gray. Confirm color requirements for each door with the Electronic Safety and Security Engineer's Representative prior to procurement and installation.

.5 Mounting height: 7 to 15 ft. (2.13 to 4.57 m) typical

.6 .6 Regulatory

.7 .1 FCC, CE, UL, CUL

.8 All Request to Exit Detectors shall be Honeywell IS310, or approved equivalent.

2.8. PUSH BUTTONS

2.8.1. Wall mount brushed stainless steel plate enclosure, momentary switch output, SPDT 10A @ 125/250 VAC, UL Listed.

2.8.2. Kantech PB-EXIT, or approved equivalent.

2.9. TRANSFORERMS

2.9.1. 120V input, 16V output, 40VA, 60 Hz, single phase rating, copper conductors, dry type

2.9.2. Transformers shall be designed, constructed and rated in accordance with UL, CSA and NEMA standards.

2.9.3. All transformers to be from a single manufacturer.

2.9.4. Frost, 1640, or approved equivalent.

2.10. BATTERIES

2.10.1. Gel Cell Battery back-up batteries, 12v, 7amp-hours.

2.10.2. Exaltor or approved equivalent.

2.11. ACCESS CONTROL CONTROLLER ENCLOSURES

2.11.1. Provide NEMA 4 access control controller enclosures to house and protect all controllers.

2.11.2. All access control controller enclosures shall be a single key locking metal box.

2.11.3. Size as required to house and protect all controllers.

2.11.4. Equipped with door tamper switch. Connect each door tamper switch to the access control system.

2.11.5. The quantity and size of access control controller enclosures shall not exceed the real estate provided for mounting access control controller enclosures. Refer to contract drawings and coordinate as such.

2.12. TERMINAL BLOCKS

2.12.1. 600 V, 25 A minimum rating, modular, 35 mm DIN rail mounted, provision for circuit number labelling, individually removable, sized to accommodate conductor size and circuit current. Sak Series by Weidmuller Ltd., UK Series by Phoenix Terminal Blocks Ltd., WK Series by Wieland Electric Inc., Entrelec.locks shall be provided by locksmith on record.

2.13. ELECTRIFIED LOCKS

2.13.1. All electrified locks shall be provided by locksmith on record.

2.13.2. Electrified locks shall include but not limited to electric strikes, electric mortise locks, electric latch retraction, maglocks all electrified locks noted on project door hardware schedule and or architectural drawings and schedules.

2.13.3. Provide a separate power supply for electrified locking devices to facilitate complete operation of all electrified locks.

3. Execution

3.1. COORDINATION

3.1.1. The ESSC shall be responsible for the systems specified in this Section, including coordination with related trades.

3.1.2. The ESSC shall coordinate all work and submittal details with the electronic door hardware supplier to ensure proper sizing of control equipment and shall be responsible for proper sizing of interface equipment (i.e., relays, contact ratings, etc.) to eliminate interface problems.

3.1.3. Provide the following related work:

.1 Coordination of all works related to the door hardware contractor, all electrified door hardware and electrified locks.

.2 Provide all interface, wiring and connections to all electrified door hardware and electrified locks as required to facilitate a complete and operational electronic access control system.

.3 Related Electrical Works

.4 Related Control Work and/or annunciation

.5 All 120 Volt wiring and connections from power source to terminal strips in electronic low-voltage controllers, power supplies and devices.

.6 Provide cable troughs, raceway, conduits, including all back boxes and pull strings and device specific and or proprietary and or special back boxes.

3.2. CONTROLLERS AND PERIPHERAL DEVICES

3.2.1. Provide and install access control controllers/enclosures as required to house and protect all controllers.

3.2.2. All controllers and peripheral devices shall be installed and configured in accordance with manufacturer’s installation instructions and recommendations, as per the Region’s requirements and as per contract drawings and specifications.

3.2.3. Coordinate the exact mount location of peripheral device devices with the electrical contractor to ensure that all conduits and back boxes are installed in the optimal locations.

3.2.4. Coordinate exact mounting locations of all controllers on site with security Engineer's Representative and The Region.

3.2.5. Supply and install all peripheral devices where indicated on contract drawings and documents.

3.2.6. Refer to Architectural Door and Door Hardware Schedules and ensure that each peripheral device is coordinated with its respective door and door hardware.

3.2.7. All peripheral devices shall be compatible with the access control system.

3.2.8. Submit shop drawings of all peripheral devices to the Security Engineer's Representative for approval prior to procurement and installation.

3.2.9. Allow for "needs assessment sessions" with The Region to determine the exact mode/s of operation of each peripheral device.

3.2.10. Configure each peripheral device and each controller to suit the Region's requirements.

3.3. POWER SUPPLY

3.3.1. Supply and install power supplies as required for a fully functional access control system. Power supplies shall include but not limited to all controller power supplies, all electric lock power supplies and all peripheral device power supplies.

3.3.2. All power supplies shall be sized to facilitate connection of each electrified lock and each powered device to separately fused power output.

3.4. FIELD WIRING TERMINATIONS:

3.4.1. Where screw-type terminal blocks are provided, supply insulated fork tongue terminals. Sta-Kon by Thomas & Betts Ltd., Scotchlok by 3M Canada Inc.

3.5. ELECTRIC LOCKS

3.5.1. All electric locks shall be supplied and installed by others.

3.5.2. Electrified locks shall include but not limited to :

.1 Electric strikes

.2 Magnetic locks/Maglocks

.3 Electric mortise locks

.4 Electric latch retraction

3.5.3. Coordinate with the door hardware contractor and electrical contractor, make all wire connections to all electric locks as required for a complete access control system.

3.5.4. Supply and install wiring as required for complete operation all access control devices and systems.

3.5.5. Include for all costs and work associated with acquiring permits for all magnetic locks.

3.6. INSTALLATION

3.6.1. Install all system components and appurtenances in accordance with the respective manufacturer's specifications, referenced practices, guidelines, and applicable codes. Furnish all necessary interconnections, services, and adjustments required for a complete and operable system as specified. Control signal, communications, and data transmission line grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

3.6.2. Install the wiring system and integrate the system as indicated in this specification. All wiring is to be installed in dedicated conduit throughout. wiring shall not be pulled into conduits or placed in raceways, compartments, outlet boxes, junction boxes, or similar fittings with other building wiring.

3.6.3. All low voltage wiring outside the control console, cabinets, boxes, and similar enclosures, shall be plenum rated where required by code.

3.6.4. All wiring conductors shall be individually numbered and each cable or wiring group being extended from a controller or cabinet to a building mounted device shall be identified with the name and number of the particular device.

3.6.5. All exposed wiring inside and outside the control console, cabinets, boxes, and similar enclosures, shall be dressed down neatly and secured with wiring cleats or wire ties.

3.6.6. All exposed metallic flexible conduit and armored cable shall be dressed down neatly and secured with low profile, metal fasteners.

3.6.7. All cabinets, boxes, and similar enclosures containing security system components and/or cabling and which are easily accessible to employees or to the public shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible.

3.6.8. All junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamper proof screws.

3.6.9. End-of-Line resistors shall be installed at the field device location and not at the controller location.

3.6.10. System devices identified on building drawings are intended to generally indicate areas where such devices are to be located. Determine and coordinate the final locations of these devices on site with the electrical contractor to ensure that all conduits and associate Backboxes are located where respective devices will be installed. Be responsible for all costs resulting from failure to execute the above.

3.6.11. Riser diagrams are schematic and do not show every conduit, wire box, fitting, or other accessories. Provide such materials as necessary for a complete and functioning installation. Install in accordance with referenced codes and these specifications. Use weatherproof equipment or covers where installed in areas exposed to weather.

3.6.12. All equipment shall be mounted with sufficient clearance to meet all applicable codes and facilitate observation and testing. All equipment shall be securely fastened with appropriate fittings to ensure positive grounding and be free of ground loops.

3.6.13. Determine conductor requirements for each device in accordance with the Contract Documents and manufacturer requirements.

3.6.14. Install cable in accordance with Security System manufacturer requirements

3.6.15. Neatly route cables parallel or perpendicular to building lines.

3.6.16. Provide J hooks and other cable support systems (spaced at regular intervals) within accessible ceiling spaces. Fasten cables to the cable support systems and provide strain relief to protect cables and ensure compliance with required cable bends.

3.6.17. Keep cable not run in conduit a minimum of 18” from high voltage (120 VAC and above) circuits (e.g. light fixtures, wire run parallel with conduit, transformers, electric controllers, etc.).

3.6.18. Run cables at least six inches from the communications cable plant, intercom wires, input/output wires, and siren wires.

3.6.19. Route wire and cable as required preventing interference and signalling contamination of both Security System cable and cable associated with other systems. Coordinate the routing of wire and cable requiring isolation from power, radio frequency (RF), telephone, etc.

3.6.20. Provide sleeves and code compliant fire proofing techniques for all penetrations of fire rated partitions, masonry walls, and slabs, where the penetrations are made by or used for installation of Security Systems.

3.6.21. Separate high voltage (120 VAC and above) cables from low voltage cables within enclosures

3.6.22. Run wire and cable continuous from device location to the final point of termination. No mid-run cable splices will be allowed

3.6.23. Bundle and tie wire and cable with cable ties.

3.6.24. Cover exposed high voltage (120 VAC and above) power terminations within controller, power distribution cabinets and other security enclosures.

3.7. LABELED FRAMES, DOORS AND ENCLOSURES

3.7.1. In no instance shall any UL labeled door, frame or enclosure be drilled, cut, penetrated, or modified in any way.

3.8. PROGRESS OBSERVATION

3.8.1. Security Engineer's Representative will conduct progress observations during construction to verify construction progress and verify the construction schedule. Coordinate progress observation site visits with the Contractor.

3.8.2. Security Engineer's Representative will conduct the following minimum progress observations:

.1 Security Conduit Rough-in and Preliminary Wire and Cable Installation

.1 The intent of this observation is to verify that adequate and proper conduit rough-in is installed, verify that wire and cable are being properly installed and labeled, and identify and resolve issues regarding conduit and wire and cable installation.

.2 Preliminary Wire Termination Progress

.1 The intent of this observation is to verify that the contractor will install and terminate equipment in accordance with specifications and standards.

3.8.3. Observations will occur upon initial installation of each type of equipment (i.e. Controllers, Card readers, alarm devices, junction boxes, etc.).

3.8.4. Observations must be complete prior to proceeding with the installation of remaining similar or like equipment.

3.8.5. The Electronic Safety and Security Contractor shall coordinate appropriate timing of each observation with the general contractor, security Engineer's Representative as required to meet intended goals.

3.8.6. The reviewers will issue reports for each observation to summarize findings and document clarifications noted during the observation.

END OF SECTION

# 1. General

## 1.1. PURPOSE

1.1.1. The network video management systems (NVMS) system, Cameras and accessories form part of the overall security strategy implemented and the system shall provide real time surveillance, recording of real time events and historical video data for video evidence of a security event; and provide a deterrent throughout the facility and the site at designated locations as required in the contract document.

## 1.2. SCOPE OF WORK

1.2.1. The work covered by this section includes the furnishing, installation and activation of all equipment & materials associated with complete Closed Circuit Television (CCTV) Systems as specified herein. This work may include, but is not limited to integration with the associated subsystems and components listed in these sections.

1.2.2. The requirements of the conditions of the Contract, Supplementary Conditions, and General requirements apply to the work specified in this section.

## 1.3. SYSTEM CONFIGURATION

1.3.1. An existing DVMS system is fully integrated with the Honeywell EBI access control system.

1.3.2. The new camera equipment shall be an extension of and shall be integrated with the existing DVR (Digital Video Recorder).

1.3.3. Provide all software licences as required for a complete turnkey video system.

1.3.4. Allow for configuration and programming of additional devices.

1.3.5. Provide all security video cameras, pan/tilt/zoom (PTZ) cameras, mounts, housings, power supply systems, network cables, connectors, equipment racks, monitors and consoles, computer controlled network switchers, workstations, network video recorders, encoders, decoders, displays, and all other hardware and software to provide a fully operational system.

1.3.6. Video Management System Supported DVR Models listed below:

.1 HRE16R48D1T0 Rapid Eye Hybrid 16 channel, 1TB storage

.2 HRE16R48D500 Rapid Eye Hybrid 16 channel, 500 Gb storage

.3 HRE4R12D1T0 Rapid Eye Analog, 4 channel, 1TB

.4 HRE4R12D500 Rapid Eye Analog, 4 channel, 500

.5 HRE8R12D1T0 Rapid Eye Analog, 8 channel, 1TB

.6 HRE8R12D500 Rapid Eye Analog, 8 channel, 500

# 2. Products

## 2.1. GENERAL

2.1.1. All products and materials must be new and approved in the pre-installation submittals. Provide all equipment for a complete and operational IP based Security CCTV System Provide client with the necessary licenses as required for a complete and operational IP based video surveillance system

2.2. CCTV CAMERA TYPES

2.2.1. Refer to the list below and provide CCTV cameras with the relative features as indicated: Where features are indicated:

2.3. NETWORK CAMERAS:

2.3.1. Honeywell TO BE DETERMINED

2.3.2. All IP CCTV cameras that are located within 90 metres of the Security system IP data switch shall utilize 4 pair Category 6 cabling as a transmission medium.

2.3.3. All IP CCTV cameras that are located beyond 90 metres from the Security system IP data switch shall utilize 4 pair Category 6 UTP cabling, multimode fibre optic cabling or coaxial cabling as a transmission medium.

2.3.4. Provide Ethernet over twisted pair extenders, fibre optic to twisted pair media converters or Ethernet over coaxial extenders as required to facilitate complete connectivity of each respective CCTV camera.

2.4. FIBRE OPTIC TO TWISTED PAIR MEDIA CONVERTER

2.4.1. Xxxx

2.5. ETHERNET OVER COAXIAL EXTENDERS

2.5.1. Xxxx

3. Execution

3.1. COORDINATION

3.1.1. Provide the following related work:

.1 Communications (IT)

.2 Electrical Works

.3 All 120 Volt wiring and connections from power panels to terminal strips in electronic low-voltage panels, power supplies and devices.

.4 All raceway, conduit to the device(s), including all back boxes and pull strings and the installation of all special back boxes.

3.2. CAMERAS AND ACCESSORIES

3.2.1. Provide and install camera housing and mounting accessories for complete operation of the videos surveillance system.

3.2.2. Coordinate the exact mount location of devices with the electrical contractor to ensure that all conduits and back boxes are installed in the optimal locations.

3.2.3. Coordinate exact mounting locations of all cameras on site with security Engineer's Representative and client.

3.2.4. Submit shop drawings to the Security Engineer's Representative for review prior to procurement and installation.

3.2.5. Allow for “needs assessment sessions” with client to determine the exact camera settings.

3.3. POWER SUPPLY

3.3.1. Supply and install power supplies as required for a fully functional video Surveillance System.

3.3.2. All power supplies shall be installed to manufacturer’s recommendations.

3.4. INSTALLATION

3.4.1. Supply, install, configure and configure all CCTV system wiring, devices and software as required for a complete and operational CCTV System.

3.4.2. All camera installation, configuration, setup, program and related work shall be performed by technicians thoroughly trained by the manufacturer in the installation and service of the equipment provided.

3.4.3. Provide all camera brackets as required for each camera’s application.

3.4.4. Carefully follow instructions in documentation provided by the manufacturer to insure all steps have been taken to provide a reliable, easy-to-operate system.

3.4.5. All equipment shall be tested and configured in accordance with instructions provided by the manufacturer prior to installation.

3.4.6. All firmware found in CCTV System active devices shall be the latest and most up-to-date provided by the manufacturer.

3.4.7. All equipment requiring users to log on using a password shall be configured with user/site-specific password/passwords. No system/product default passwords shall be allowed.

3.4.8. Final CCTV camera viewing requirements to be determined by owner. Coordinate with the owner and obtain viewing parameters for each CCTV Camera. Adjust all CCTV cameras to meet the owner’s requirements.

3.4.9. Adjust each CCTV camera to obtain the best quality image or CCTV camera image that is acceptable to the client.

3.4.10. All domes must have the password protection feature enabled to protect against unauthorized changes to dome programming. All PTZ domes will be operated in continuous mode running an operator defined pattern, pre-set tour, or combination pattern/pre-set tour. PTZ dome movement criteria are to be coordinated with the System Operator(s) and Design Engineer's Representative to ensure camera coverage meets defined needs. PTZ domes must be programmed for “auto-resume” after a pre-defined time period, and on power-up.

3.4.11. Labeled frames, doors and enclosures

3.4.12. In no instance shall any UL labeled door, frame or enclosure be drilled, cut, penetrated, or modified in any way.

3.5. PROGRESS OBSERVATION

3.5.1. The Security Engineer's Representative will conduct progress observations during construction to verify construction progress and verify the construction schedule. Coordinate progress observation site visits with the Security Engineer's Representative.

3.5.2. Security Conduit Rough-in and Preliminary Wire and Cable Installation

3.5.3. The intent of this observation is to verify that adequate and proper conduit rough-in is installed, verify that wire and cable are being properly installed and labeled, and identify and resolve issues regarding conduit and wire and cable installation.

3.5.4. Preliminary Wire Termination Progress

3.5.5. The intent of this observation is to verify that the installations and terminations to equipment are in accordance with specifications and standards.

3.5.6. Observations will occur upon initial installation of each type of equipment (i.e. Panels, Card readers, alarm devices, junction boxes, etc.).

3.5.7. Observations must be complete prior to proceeding with the installation of remaining similar or like equipment.

3.5.8. Coordinate appropriate timing of each observation with the general contractor, security Engineer's Representative as required to meet intended goals.

3.5.9. The reviewers will issue reports for each observation to summarize findings and document clarifications noted during the observation.

END OF SECTION 28 23 00.00

28 31 03.00 Multiplex Fire Alarm and Voice Communication System

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.

1.1.4. Section 26 08 01.00 – TECHNICAL SERVICES DIVISION STARTUP SERVICE.

1.1.5. Section 26 05 21.00 – WIRES AND CABLES UNDER 2000 V.

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. CSA C22.2 No. 124, Mineral-Insulated Cable, latest edition.

1.2.7. CAN/ULC-S559, Standard for Equipment for Fire Signal Receiving Centres and Systems, latest edition.

1.2.8. CAN/ULC-S561, Standard for Installation and Services for Fire Signal Receiving Centres and Systems, latest edition.

1.3. SYSTEM DESCRIPTION

1.3.1. All equipment and components shall be new, and the manufacturer's current model.

1.3.2. An addressable 2 stage system suitable for high rise buildings with Fire Alarm and Firemen's Emergency Voice communication will be supplied for the building. The main fire alarm panel will be located in the CACF room on the ground floor.

1.3.3. Data gathering panels will be installed in the electrical rooms on every 3rd floor. Manual pull stations, speakers and firemen's handsets will be provided at all required exit stairs and in the landlord core areas. The typical tenant floor will be covered as if open space.

1.3.4. Speakers will be used on a typical tenant floor. Horn/ Strobes will be used in mechanical rooms, loading dock, parking levels, and other areas with a high level of ambient noise.

1.3.5. A CACF centre will be provided in the lobby area on the main floor which will house the main fire alarm control panel, annunciator, communication controls, elevator recall, smoke venting control, and master key switch for security system. In the event of a fire, air systems will operate on emergency. There are dampers being controlled, refer to the damper schedule. The smoke venting switch will control air handling units on each floor.

1.3.6. Spare modules will be provided for future tenant tie ins. Panels will be tied into emergency standby generators, fire pumps, security panels, and auxiliary and ancillary devices.

1.3.7. Elevator shafts will have a weather proof heat detector located in the pit along with a smoke detector located at the top of the shaft.

1.3.8. Emergency power feed from generator(s) or inverter(s) shall have two supervisory zones each, monitoring Generator Running and Generator General Trouble.

1.3.9. Fully supervised, addressable, microprocessor-based, fire alarm system, utilizing digital techniques for data control and digital, and multiplexing techniques for data transmission.

1.3.10. System to carry out fire alarm and protection functions; including receiving alarm signals; initiating general and two-stage alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signalling to monitoring agency.

1.3.11. Zoned, non-coded two-stage.

1.3.12. Modular in design to allow for future expansion.

1.3.13. Operation of system shall not require personnel with special computer skills.

1.3.14. System to include:

.1 Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, annunciation/display, and program control/signaling.

.2 Data Gathering Panels/Transponders with stand-alone capabilities.

.3 Power supplies.

.4 Initiating/input circuits.

.5 Output circuits.

.6 Auxiliary circuits.

.7 Wiring.

.8 Manual and automatic initiating devices.

.9 Audible and visual signaling devices.

.10 Local and remote annunciators.

.11 Printer and event log memory chip.

.12 Historic event recorder.

.13 Isolation modules.

.14 Central alarm monitoring.

.15 Programmed features.

1.4. REQUIREMENTS OF REGULATORY AGENCIES

1.4.1. System components shall be listed by ULC/CSA and comply with applicable provisions of the building code, and meet requirements of local authority having jurisdiction.

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.

1.5.2. Include:

.1 Detail assembly and internal wiring diagrams for control units and auxiliary cabinets.

.2 Overall system riser wiring diagram identifying control equipment initiating zones, signaling circuits; and identifying terminations, terminal numbers, conductors and raceways.

.3 Details for devices.

.4 Details and performance specifications for control, annunciation and peripherals with item by item cross reference to specification for compliance.

.5 Step-by-step operating sequence, cross referenced to logic flow diagram.

.6 Submit battery sizing calculations and battery selection.

1.6. OPERATION AND MAINTENANCE DATA

1.6.1. Provide operation and maintenance data for fire alarm system for incorporation into the O&M 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 USB stick, containing electronic version of fire alarm passive graphic both in PDF and CAD, as part of O&M manual.

1.7. MAINTENANCE MATERIALS

1.7.1. Include:

.1 Spare glass rods for manual pull stations, if applicable.

.2 Key for fire alarm panel, remote annunciator, and pull stations.

.3 Specialty tool for resetting sprinkler supervisory, if applicable.

.4 Spare fuses for control circuits.

.5 Beam detector calibrated test filters (if applicable).

1.8. WARRANTY

1.8.1. Provide a one year warranty including all materials, parts, and labour. Be responsible for correcting any deficiencies that are discovered during the one year warranty period, including any that are discovered by the Owner’s first annual inspection and test to CAN/ULC-S536.

1.9. TRAINING

1.9.1. Provide on-site lectures and demonstration by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

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.

2.1.11. Signal Transmitting Units and Monitoring: to CAN/ULC-S559 and CAN/ULC-S561.

2.3. SYSTEM OPERATION: VOICE COMMUNICATION - 2 STAGE - 3 CHANNEL; HIGH BUILDING, TWO-WAY VOICE COMMUNICATION SYSTEM

2.3.1. Actuation of any alarm initiating device on first stage to:

.1 Cause electronic latch to lock-in alarm state at central control unit and data gathering panel/transponder.

.2 Indicate zone of alarm at central control unit and at the remote annunciator.

.3 For high rise buildings: Cause audible signaling devices to sound continuously in ALARM tone on floor of alarm, floor above, and floor below; and at 20 strokes per minute in ALERT tone on other floors of building.

.4 Transmit signal to fire department via central station.

.5 Except for air handling systems providing make-up air to public corridors serving suites in Group C major occupancy High Buildings, cause air conditioning and ventilation fans serving more than one: storey, suite in a storey, or fire compartment, to shut down.

.1 Air handling systems providing make-up air to public corridors serving suites in Group C major occupancy High Buildings shall <u>only</u> shutdown upon activation of the duct smoke detector(s) associated with that specific mechanical unit. On general alarms activated by other initiating devices (i.e. sprinkler, pull station, smoke/heat detector, etc.), the air handling unit shall continue to operate in order to maintain corridor pressurization.

.6 For high rise buildings, provide manual ‘OFF’ switches at the main fire alarm panel in the CACF to manually stop air moving fan units that serves more than one: storey, suite, or fire compartment.

.7 Cause supply and/or exhaust fans to function automatically to provide required control of smoke movement per the mechanical smoke control matrix.

.8 Cause fire doors and smoke control doors, if normally held open, to close automatically.

.9 Cause the release of all mag-lock devices on doors that are secured closed.

2.3.2. Emergency elevator recall:

.1 Actuation of any alarm initiating devices in elevator lobbies, elevator machine room, elevator pit, or top of hoistway to cause elevators to return to primary recall floor, or to alternate recall floor, as required. Elevator recall shall not be activated upon alarms from manual pull stations or on general fire alarm condition.

2.3.3. Actuation of any alarm initiating device on second stage to:

.1 Cause speakers to sound evacuation tone throughout building.

2.3.4. If first stage alert is not acknowledged within 5 minutes, system to automatically go into second stage alarm.

2.3.5. Possible to transmit voice message from central control unit to specific zone or group of zones, while maintaining alert tone to other zones and alarm tone to yet other zones, by means of master microphone and specific zone switches to silence tones in selected zones and allow one-way voice messages over system speakers. Releasing microphone switch and returning zone switches back to original position shall re-activate tones on speakers in zones, unless tones have been silenced. Audio channel available to each speaker circuit to be automatically and dynamically selected by microprocessor. Manual selection and operation of evacuation tones / emergency paging to be provided on a floor by floor basis. The visual signal devices shall not be interrupted while voice messages/instructions are being transmitted.

2.3.6. Acknowledging alarm: indicated at central control unit.

2.3.7. Possible to silence signals by "alarm silence" switch at central control unit, after minimum 20 minutes period of operation. For residential buildings, an in-suite silence switch will silence the local annunciation for a period of not more than 10 minutes or until the next announcement or new alarm. For residential buildings, possible to automatically silence audible signal devices within dwelling units that are wired on separate signal circuits, after minimum 60 seconds period of operation, provided that they are not within the zone of initiation; reactuation of audible signal devices to comply with Building Code requirements.

2.3.8. Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.

2.3.9. Actuation of any supervisory device to:

.1 Cause electronic latch to lock-in supervisory state at central control unit and data gathering panel/transponder.

.2 Indicate respective supervisory zone at central control unit and remote annunciator.

.3 Cause audible signal at central control unit to sound.

.4 Activate common supervisory sequence.

2.3.10. Resetting alarm or supervisory device not to return system indications/functions back to normal until control unit has been reset.

2.3.11. Trouble on system to:

.1 Indicate circuit in trouble at central control unit.

.2 Activate "system trouble" indication, buzzer and common trouble sequence. Acknowledging trouble condition to silence audible indication; visual indication to remain until trouble is cleared and system is back to normal.

2.3.12. Suppress troubles on system during course of alarm.

2.3.13. Trouble condition on any circuit in system shall not initiate alarm conditions.

2.4. SYSTEM OPERATION: VOICE COMMUNICATION - 2 STAGE - 3 CHANNEL; NON-HIGH BUILDING; ONE WAY VOICE COMMUNICATION SYSTEM

2.4.1. Actuation of any alarm initiating device on first stage to:

.1 Cause electronic latch to lock-in alarm state at central control unit and data gathering panel/transponder.

.2 Indicate zone of alarm at central control unit and at the remote annunciator.

.3 Cause audible signaling devices to sound at 20 strokes per minute in ALERT tone throughout the building.

.4 Transmit signal to fire department via central station.

.5 Cause air conditioning and ventilation fans serving more than one: storey, suite in a storey, or fire compartment, to shut down.

.6 Cause supply and/or exhaust fans to function automatically to provide required control of smoke movement per the mechanical smoke control matrix (if applicable).

.7 Cause fire doors and smoke control doors, if normally held open, to close automatically.

.8 Cause the release of all mag-lock devices on doors that are secured closed.

2.4.2. Emergency elevator recall:

.1 Actuation of any alarm initiating devices in elevator lobbies, elevator machine room, elevator pit, or top of hoistway to cause elevators to return to primary recall floor, or to alternate recall floor, as required. Elevator recall shall not be activated upon alarms from manual pull stations or on general fire alarm condition.

2.4.3. Actuation of any alarm initiating device on second stage to:

.1 Cause speakers to sound continuously in ALARM evacuation tone throughout building.

2.4.4. If first stage alert is not acknowledged within 5 minutes, system to automatically go into second stage alarm.

2.4.5. Possible to transmit voice message from central control unit to specific zone or group of zones, while maintaining ALERT or ALARM tones to other zones, by means of master microphone and specific zone switches to silence tones in selected zones and allow one-way voice messages over system speakers. Releasing microphone switch and returning zone switches back to original position shall re-activate tones on speakers in zones, unless tones have been silenced. Audio channel available to each speaker circuit to be automatically and dynamically selected by microprocessor. Manual selection and operation of evacuation tones / emergency paging to be provided on a floor by floor basis. The visual signal devices shall not be interrupted while voice messages/instructions are being transmitted.

2.4.6. Acknowledging alarm: indicated at central control unit.

2.4.7. Possible to silence signals by "alarm silence" switch at central control unit, after a minimum 20 minute period of operation.

2.4.8. Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.

2.4.9. Actuation of any supervisory device to:

.1 Cause electronic latch to lock-in supervisory state at central control unit and data gathering panel/transponder.

.2 Indicate respective supervisory zone at central control unit and remote annunciator.

.3 Cause audible signal at central control unit to sound.

.4 Activate common supervisory sequence.

2.4.10. Resetting alarm or supervisory device not to return system indications/functions back to normal until control unit has been reset.

2.4.11. Trouble on system to:

.1 Indicate circuit in trouble at central control unit.

.2 Activate "system trouble" indication, buzzer and common trouble sequence. Acknowledging trouble condition to silence audible indication; visual indication to remain until trouble is cleared and system is back to normal.

2.4.12. Suppress troubles on system during course of alarm.

2.4.13. Trouble condition on any circuit in system shall not initiate alarm conditions.

2.5. CONTROL PANEL

2.5.1. Central control unit (CCU):

.1 Suitable for Data Communication Link Style C (DCL-C) unless otherwise noted on the drawings: to CAN/ULC-S524.

.2 Features specified are minimum requirements for microprocessor-based system with digital data control and digital multiplexing techniques for data transmission.

.3 Minimum capacity of 2000 addressable monitoring and 500 addressable control/signal points. Points may be divided between 2 communication channels in distributed system, each channel operating independently of other. Faults on one communication channel not to affect operation of other channel.

.4 System to provide for priority reporting levels, with fire alarm points assigned highest priority, supervisory and monitoring lower priority, and third priority for troubles. Possible to assign control priorities to control points in system to guarantee operation or allow emergency override as required.

.5 Integral power supply, battery charger and standby batteries.

.6 Circuitry to continuously monitor communications and data processing cycles of microprocessor. Upon failure, audible and visual trouble indication to activate.

.7 Communication between CCU and remote DGP's/TPR's to be supervised, DCLA. Should communications fail between CCU and remote units, audible and visual trouble to be indicated at CCU. Data communication to be binary DC, baseband, time-division multiplex, half-duplex. Each data channel: capable of communicating up to distance of 3,000 m.

.8 Communication between nodes in networked system to be supervised, DCLA. Should communications fail between any 2 nodes, other nodes on loop to continue to communicate with each other and programmed functions on communicating nodes to continue operating.

.9 Support up to 4 RS-232-C I/O ports. CCU output: parallel ASCII with adjustable baud rates to allow interface of any commercially available printer, terminal or PC.

.10 Equipped with software routines to provide Event-Initiated-Programs (EIP); change in status of one or more monitor points, may be programmed to operate any or all of system's control points.

.11 Software and hardware to maintain time of day, day of week, day of month, month and year.

.12 Software to operate variable sensitivity addressable smoke detectors and annunciate their status and sensitivity settings at control panel.

2.5.2. Two-way voice communication system:

.1 Two-way voice communication to each floor or zone via emergency telephone. Master telephone and power supply housed in central control panel, c/w flexible, coiled, self-winding 1.5 m extension cord.

.2 Manual selection of telephone circuits on floor by floor basis. Each telephone circuit to have own selection switch at control panel. Incoming call from remote telephone to activate call-in signal and flash circuit status indicator. Lifting master handset and operating circuit selector switch to illuminate circuit status indicator steady, and connect circuit to telephone voice channel, selected by microprocessor at control panel. Subsequent call-ins indicated with flashing indicator at control panel, but not connected until their circuit selector switch is activated.

.3 Permit announcements / voice messages to be made from remote telephone to selected zones over system speakers, through phone/paging interface at control panel.

2.6. DATA GATHERING PANELS (DGP'S) /TRANSPONDERS

2.6.1. Fire control modules: distributed throughout building complex in separately enclosed units (DGP'S) and interconnected to central control unit utilizing multiplex data transmission techniques.

2.6.2. Fire alarm integrated DGP's: microprocessor based, provide interface between standard alarm input/output devices and central control unit.

2.6.3. Each DGP: circuitry with ability to detect failure in communication with CCU resulting from faults in communication wiring. In event of loss of communication with CCU, DGP capable of operating in stand-alone mode. In this mode, DGP capable of reacting to connected input devices, and apply stand-alone programming to determine state of connected outputs. Stand-alone programming instructions: independent of, but capable of executing same type of algorithms as that of CCU.

2.6.4. Each DGP: self-contained unit, with integral power supply, battery charger and standby batteries. Short circuit, over voltage, and brown-out monitoring to protect powered components by automatically switching to standby batteries whenever trouble condition exists in power supply.

2.6.5. Addressable DGP's:

.1 DGP's are to be of the addressable type which provide two-way data communication with up to 128 addressable devices/interface modules, utilizing digital poll/response protocol communication format. Each addressable device: uniquely identified by own address, set at time of installation.

.2 Interface modules: facilitate connection of non-addressable devices (e.g. flow switch) to addressable DGP; provided in different types for connection to monitoring devices (e.g. flow/tamper switch), signalling devices (e.g. bells, horns), and control functions (e.g. fan shutdown, door release); communicate with addressable DGP over minimum number of wires (specified by manufacturer).

.3 Possible to connect all 3 types of addressable interface modules (monitoring, signal and control) to same addressable communication loop).

.4 Addressable DGP's: self-contained, as specified.

.5 Possible to connect variable-sensitivity addressable smoke detectors together with other addressable devices to same addressable communication loop.

2.7. POWER SUPPLIES

2.7.1. 120V, 60 Hz as primary source of power for system. The circuit shall be labelled at the main power distribution panel as FIRE ALARM. The fire alarm disconnect must be locked, a locked electrical room or panel door does not constitute the lock for the disconnect, and painted red.

2.7.2. Voltage regulated, current limited distributed system power.

2.7.3. Primary power failure or power loss (less than 102 V) will activate common trouble sequence.

2.7.4. Interface with battery charger and battery to provide uninterruptible transfer of power to standby source during primary power failure or loss.

2.7.5. Abnormal operating conditions such as a fault in battery charging circuit, short or open in the battery leads, shall activate common trouble sequence and standby power trouble indicator.

2.7.6. Standby batteries: 5 years NiCad sealed, maintenance free.

2.7.7. Continuous supervision of wiring for external initiating and alarm circuits are to be maintained for 24 hrs with capability of maintaining alarm activation for a minimum of 2 hrs, immediately following 24 hrs of supervision.

2.8. INITIATING/INPUT CIRCUITS

2.8.1. Receiving circuits for alarm initiating devices such as manual pull stations, smoke detectors, heat detectors and water flow switches, wired in DCLC with isolation modules, as per CAN/ULC-S524, configuration to central control unit or DGP's/transponders.

2.8.2. Alarm receiving circuits (active and spare) are to be compatible with smoke detectors and open contact devices.

2.8.3. Actuation of alarm initiating device is to cause system to operate as specified in "System Operation".

2.8.4. Receiving circuits for supervisory, N/O devices are to be wired in DCLA configuration to central control unit or DGP's/transponders.

2.8.5. Actuation of supervisory initiating device is to cause the system to operate as specified in "System Operation".

2.8.6. Sprinkler devices such as pressure switches and flow switches are to have the tamper switch wired after the switch and before the EOL, to create a trouble condition while still allowing the device to electrically initiate its respective zone.

2.8.7. Low room temperature devices are to be provided in sprinkler rooms whenever a dry sprinkler system is provided.

2.9. ALARM OUTPUT CIRCUITS

2.9.1. Alarm output circuit are to be connected to signals, wired in class B configuration to the central control unit or DGP's/transponders.

2.9.2. The signal circuits' operation is to be capable of sounding bells, horns as required. Each signal circuit: rated at 3 A, 24 VDC; self-protected from overloading/overcurrent.

2.9.3. Manual alarm silence, automatic alarm silence and alarm silence inhibit is to be provided by system's common control.

2.9.4. Speaker circuits operation: follow system programming; capable of reproducing tones and voice fed by audio channels.

2.9.5. Audio channel available to each speaker circuit to be automatically and dynamically selected by system’s microprocessor.

2.9.6. Manual selection and operation of alarm tones to be provided on floor by floor basis.

2.9.7. Manual selection for emergency paging to be provided on floor by floor basis.

2.9.8. Proprietary evacuation control switch to be provided to bypass automatic system programming, once manual control of the system has been assumed by authorized personnel.

2.9.9. Separate circuits shall be provided for audible signal devices on each floor area.

2.9.10. Audible signal devices within dwelling units or suites of residential occupancy shall be wired on separate signal circuits from those not within suites of residential occupancy or dwelling units.

2.9.11. Provide a manual signal silence switch within dwelling units or suites of residential occupancy. The switch will silence the local annunciation until the next announcement or new alarm.

2.9.12. Provide 25% spare capacity in visual signal device circuits to allow for site adjustments of visual signal device candela ratings.

2.10. EMERGENCY TELEPHONE CIRCUITS

2.10.1. Telephone circuits for connection of remote emergency telephones: wired in class A configuration to central control unit or to DGP’s/transponders.

2.10.2. Two-way communication via telephone voice circuits between master telephone handset and remote telephones controlled by CCU.

2.10.3. Field wiring of telephone circuits between remote handsets and CCU or DGP to be supervised for open circuits and grounds.

2.11. AUXILIARY CIRCUITS

2.11.1. Auxiliary contacts for control functions.

2.11.2. Actual status indication (positive feedback) from controlled device.

2.11.3. Alarm or supervisory trouble on system to cause operation of programmed auxiliary output circuits.

2.11.4. Five sets of separate contacts for elevator fire alarm recall, for each elevator or bank of elevators sharing a common shaft and common fire detectors:

.1 Elevator recall to primary floor, from elevator lobby smoke detectors on all floors except primary recall floor.

.2 Elevator top of shaft detection signal to elevator controller.

.3 Elevator pit detection signal to elevator controller.

.4 Elevator machine room detector signal to elevator controller.

.5 Elevator recall to alternate floor, from elevator lobby smoke detector(s) at primary recall floor.

2.11.5. Upon resetting system, auxiliary contacts are to return to normal or to operate as pre-programmed.

2.11.6. Fans: stagger-started upon system reset; timing circuit to separate starting of each fan or set of fans connected to auxiliary contact on system. Timing circuit: controlled by CCU.

2.11.7. Auxiliary circuits: rated at 2 A, 24 V dc or 120 V ac, fuse-protected.

2.12. AMPLIFIERS

2.12.1. Modular in construction, solid state in design, with power output of 70 V RMS, for constant voltage distribution to speaker circuits.

2.12.2. Continuously supervised for proper operation. Loss of power, open or short circuit on input or output of amplifier, or total amplifier failure, to activate trouble sequence at central control unit with visual indication.

2.12.3. Integral power supply, powered through system power supply, housed in central control unit and supported by standby batteries in case of power failure.

2.12.4. Riser amplifiers: housed in central control unit, with outputs connected to voice communication risers.

2.12.5. Standby amplifiers: sized to meet requirements of largest amplifier, with automatic transfer to be on a priority basis.

2.12.6. Amplifiers shall have 25% spare capacity for future expansion.

2.13. WIRING

2.13.1. All fire alarm system wiring must be new.

2.13.2. 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.To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.

2.13.4. To signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.

2.13.5. To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

2.13.6. To speaker circuits: twisted, shielded pairs, and in accordance with the manufacturer’s requirements.

2.13.7. To telephone circuits: twisted, shielded pairs, and in accordance with the manufacturer’s requirements.

2.13.8. All initiating circuits are to be wired in a DCL-C (i.e. Class A) configuration.

2.13.9. All output circuits are to be wired in a Class B configuration, unless otherwise shown on the drawings or unless otherwise indicated below.

2.13.10. All wiring between junction boxes and water flow switch, pressure switch, or supervisory switches will be in liquid tight flexible conduit.

2.13.11. Where a fire alarm transponder or annunciator located in one fire compartment is connected to a central processing unit or another transponder or annunciator located in a different fire compartment, the data communication link conductors connecting them shall be fire rated for at minimum one (1) hour. Where fire alarm system branch circuits connect transponders and individual fire alarm devices located on another storey, the branch circuits shall be fire rated for at minimum one (1) hour between the transponder and the first fire alarm device located on another storey than the transponder. Provide twisted, shielded pair Mineral-Insulated fire rated cables configured to eliminate interference and cross-talk, except where fire alarm riser diagram clearly illustrates another fire rating approach for particular conductors.

2.14. MANUAL ALARM STATIONS

2.14.1. Addressable manual pull station.

.1 Pull lever, break glass rod, semi-flush wall mounted type, 2 stage, electronics to communicate station's status to addressable module/transponder over 2 wires and to supply power to station. Station address to be set on station in field.

.2 Provide two pole for direct disconnect of magnetic locking devices local to the devices.

2.15. AUTOMATIC ALARM INITIATING DEVICES

2.15.1. Addressable thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57 deg. C., rate of rise 8.3 deg. C. per minute:

.1 Electronics to communicate detector's status to addressable module/transponder.

.2 Detector address to be programmed on site.

2.15.2. Smoke detector: photo electric:

.1 Twistlock plug-in type with fixed base.

.2 Wire-in base assembly with integral red alarm LED.

.3 Auxiliary output contact.

2.15.3. Duct type smoke detectors: photo-electric with sampling tubes:

.1 Twistlock plug-in type with fixed base.

.2 Wire-in base assembly with integral red alarm LED.

.3 Auxiliary output contact.

.4 Properly sized air sampling tubes.

2.15.4. Beam type detectors: long range and short range:

.1 Complete with transmitter and receiver.

.2 Short range operating distance of 9-30 meters.

.3 Long range operating distance of 30-100 meters.

.4 Operating temperatures shall be of -5 to 55 deg. C.

.5 The beam detector shall feature alignment LEDs on both the receiver and the transmitter and automatic gain control.

.6 Beam detector calibrated test filters, if applicable.

2.15.5. Addressable variable-sensitivity smoke detectors:

.1 Photo-electric type.

.2 Electronics to communicate detector's status to addressable module/transponder.

.3 Detector address to be set on detector head in field.

.4 Sensitivity settings: 3 settings, determined and operated by control panel. No shifting in detector sensitivity due to atmospheric conditions (dust, dirt) within certain parameters.

.5 Ability to annunciate minimum of 2 levels of detector contamination automatically with trouble condition at control panel.

.6 Auxiliary output contact.

2.15.6. Water flow switches: lever and pressure type:

.1 Shall have a mechanical alarm transmitted delay adjustable from 0-60 seconds. Initial settings shall be 30-45 seconds. Times will be recorded and submitted to Engineer’s Representative.

.2 The tamper switch located within the water flow switch shall be wired as per manufacturer’s recommendations such that if the housing is open a latching trouble will be initiated.

2.15.7. Sprinkler and standpipe valve supervisory switches:

.1 The tamper switch located within the supervisory switch shall be wired as per manufacturer’s recommendations such that if the housing is open a latching trouble will be initiated.

2.15.8. Smoke alarms: ionization and photo electric.

.1 Twistlock plug-in type with fixed base.

.2 Wire-in base assembly with integral red and green LEDs for alarm/normal status.

.3 Silence button to silence nuisance alarms.

.4 Test button to verify circuitry and alarm operation.

.5 Electrical Rating: 120 VAC, 60 Hz <u>and</u> Battery Backup

.1 Battery capacity to provide power for <u>minimum</u> 7 days in normal condition, followed by 4 minutes of alarm.

.6 Visual signal device light with the following performance requirements:

.1 The flash rate shall not exceed two flashes per second (2 Hz) nor be less than one flash every second (1 Hz) throughout the listed voltage range of the appliance.

.2 Maximum pulse duration in accordance with NFPA 72 “National Fire Alarm and Signaling Code.”

.3 Shall be clear or nominal white and shall be minimum 175 cd but not exceed 1000 cd (effective intensity).

.4 The visual signal device light shall be synchronized where multiple smoke alarm visual signal devices are installed within the same area and/or viewpoint.

2.15.9. Combination Smoke/Carbon Monoxide alarms:

.1 Smoke Detection: ionization.

.2 Twistlock plug-in type with fixed base.

.3 Wire-in base assembly with integral red and green LEDs for alarm/normal status.

.4 Silence button to silence nuisance alarms.

.5 Test button to verify circuitry and alarm operation.

.6 Electrical Rating: 120 VAC, 60 Hz and Battery Backup

.1 Battery capacity to provide power for minimum 7 days in normal condition, followed by 4 minutes of alarm.

.7 Visual signal device light with the following performance requirements:

.1 The flash rate shall not exceed two flashes per second (2 Hz) nor be less than one flash every second (1 Hz) throughout the listed voltage range of the appliance.

.2 Maximum pulse duration in accordance with NFPA 72 “National Fire Alarm and Signaling Code.”

.3 Shall be clear or nominal white and shall be minimum 175 cd but not exceed 1000 cd (effective intensity).

.4 The visual signal device light shall be synchronized where multiple smoke alarm visual signal device lights are installed within the same area and/or viewpoint.

2.16. AUDIBLE SIGNAL DEVICES

2.16.1. 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: 87 dB at 3 m with 1 W tap.

2.16.2. 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 100 db at 3 m.

.4 Frequency response: 400 to 4000 Hz.

.5 Available in 25 or 70 Vrms.

2.17. VISUAL ALARM SIGNAL DEVICES

2.17.1. Visual signal device 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.

.3 “FIRE” installed red letters.

.4 Operating on 20-24 V dc.

.5 Field adjustable for 15 cd, 30 cd, 75 cd, 110 cd, and 115 cd, unless specified otherwise.

.6 Designed for surface mounting on ceiling or walls as indicated.

2.17.2. Fire do not enter signs and their accessories:

.1 Compliant with CAN/ULC-S527 “Standard for Control Units for Fire Alarm Systems” and/or CAN/ULC S526 “Standard for Visual Signal Devices for Fire Alarm and Signaling Systems, Including Accessories.”

.2 Powered by fire alarm system; operating on 24 V dc.

.3 Fire alarm signaling device.

2.18. COMBINATION AUDIBLE AND VISUAL SIGNAL DEVICES

2.18.1. Combination Speaker Strobes, complying with the requirements noted above for: Audible Signal Devices and Visual Alarm Signal Devices.

2.18.2. Combination Horn Strobes, complying with the requirements noted above for: Audible Signal Devices and Visual Alarm Signal Devices.

2.19. END-OF-LINE DEVICES

2.19.1. 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.

2.20. REMOTE ANNUNCIATORS

2.20.1. LED type, with designation cards to indicate zones.

2.20.2. Display:

.1 Alarms for alarm initiating circuits.

.2 Common supervisory alarm for supervisory initiating circuits.

.3 Common system trouble.

2.20.3. Trouble buzzer:

.1 Acknowledging trouble at main panel to silence trouble buzzers in system.

2.20.4. Supervised, with LED test button.

2.20.5. Interconnected with main fire alarm panel at minimum.

2.21. REMOTE PRINTER

2.21.1. System printer: to give a hard copy record of system events c/w following features:

.1 120 V ac, 60 Hz.

.2 80 columns.

.3 160 cps.

.4 Utilizes fan fold paper.

.5 Connected to RS-232 output at central control panel.

2.22. ISOLATION MODULE

2.22.1. 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.

2.23. CENTRAL ALARM MONITORING

2.23.1. Provide Signal Transmitting Unit that utilizes internet connection as primary communications method and cellular network as secondary (back-up) communications method.

.1 Provide remote antenna for cellular network reception for Signal Transmitting Unit, if location of Signal Transmitting Unit in the building does not facilitate adequate cellular network strength.

2.23.2. Provide a demarcation point; refer to CAN-ULC-S524 Annex E.

2.23.3. Provide monitoring of the system including alarm zones, supervisory zones, and trouble signals.

2.24. PROGRAMMED FEATURES:

2.24.1. By-pass feature for signalling devices:

.1 Bypassing of audible devices shall be provided through the programmable keys. The use of the feature is intended for personnel with programming access.

2.24.2. Evacuation feature.

.1 Evacuation key will be programmed and accessible for any personnel working on the fire alarm panel.

2.25. REMOTE TERMINAL

2.25.1. LCD flat panel monitor: 120 V, 60 Hz, to incorporate 100% solid state circuitry, with 431 mm screen and front mounted controls for brightness, contrast, vertical and horizontal hold and power ON/OFF switch.

2.26. FIRE ALARM ZONE PASSIVE GRAPHIC DISPLAY

2.26.1. Layout

.1 The fire alarm zone passive graphic display shall be completed in the latest version of AutoCAD. The drawing shall indicate all the building floor plans and respective fire alarm zones with the description corresponding to the zone indication at the fire alarm control panel and annunciator.

.2 The fire alarm zones indicated for each floor shall be clearly defined with borders to indicate zone separation.

.3 The general font style shall be Helvetica upper case. Text size:

.1 6 mm in height for building name and 4.5 mm for municipal address and floor plans all coloured green.

.2 Main entrance arrow and text shall be Romans forward slant style 3 mm in height coloured cyan.

.3 Fire alarm zones and equipment notes shall be 3 mm in height coloured red.

.4 Fire hose cabinets shall be Romans forward slant style 3 mm in height coloured cyan.

.4 Graphic display colours.

.1 Outline of building plan to be black line on white background.

.2 All egress corridors shall be clearly defined with Red colour #13 solid hatch pattern.

.3 All stairs and elevators shall be indicated using yellow solid hatch pattern.

.5 Include the following information on the graphic display:

.1 A north arrow on the upper left corner of the zone graphic.

.2 “You are here” location in Red and properly orientated to the viewer when standing in front of the graphic.

.3 A drawing scale graph and drawing file number located in the lower right of the zone graphic.

.4 Building name and number at the bottom centre of the graphic display with municipal address indicated on the next line below.

.5 The main building entrance and street reference.

.6 Location of fire alarm control panel and annunciators, fire department connections, fire pumps, fire hose cabinets and associated standpipe and sprinkler valves.

.7 Location of main gas valve, suppression systems, chemical storage vaults, major mechanical equipment and duct smoke detectors indicating zone number.

.8 Substation and transformer locations indicating primary and secondary voltages.

2.26.2. Construction

.1 The graphic display shall be:

.1 Printed on white heavy weight 40lb. coated bond with colour UV inks, laminated on 1.5 mm styrene board and covered with clear Lexan.

.2 Standard passive graphic display size ranges from 8.5”x11” to 23”x35”. The final size of the graphic may vary depending on the layout requirements and site conditions.

.2 Trim to be No. 4 stainless steel finish.

2.26.3. Location

.1 Install graphic display adjacent to each fire alarm annunciator panel and the fire alarm control panel.

.2 Graphic display to be fixed to the building structure or fire alarm control panel enclosure using tamper proof screws at each corner and at the midpoint on all four sides.

2.26.4. Approval Drawings

.1 Submit three full colour print copies of the passive display graphic for review by the Owner, the Engineer’s Representative and the local fire department.

.2 Include the final approved zone graphic drawing in electronic format with the as-built drawings.

2.27. ANCILLARY DEVICES

2.27.1. Remote relay unit to initiate fan shutdown, magnetic door looks and door hold open devices.

2.28. STI STEEL WEB STOPPERS, DETECTOR COVERS

2.28.1. Provide STI 9600 series detector cover for areas where sporting events or similar activities avail.

2.29. STI STOPPER 2 & WEATHER PROOF STOPPER 2, COVERS FOR MANUAL STATIONS

2.29.1. Provide STI Stopper 2 1100 series manual station covers for all vandal resistant locations identified on the electrical and architectural drawings.

2.29.2. Provide Weather Proof Stopper 2 1200 (flush mount) or 3100 (surface mount) series manual station covers for all weather proof locations and outdoor applications identified on the electrical and architectural drawings.

2.30. RELAY BASE, FOR FIRE DETECTORS

2.30.1. 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.

2.31. MANUFACTURERS

2.31.1. The following are acceptable manufacturers:

.1 Chubb Edwards.

.2 Simplex.

.3 Mircom.

.4 Siemens.

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. Install duct type detectors complete with sampling tubes. Ensure duct type smoke detectors are installed far enough away from humidifiers to avoid false alarms; coordinate location of duct type smoke detector with Mechanical Contractor. If false alarms occur, relocate duct type smoke detector at no cost to the Owner.

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. Adjust visual signal device candela ratings upward, where required to meet coverage. Utilize spare visual signal device circuit capacity required in Part 2.

3.1.9. Install remote annunciator panels and connect to annunciator circuit wiring.

3.1.10. Install door releasing devices.

3.1.11. Install remote relay units to control fan shut down.

3.1.12. Where smoke dampers or combination smoke and fire dampers are shown, terminate damper position monitoring wiring for both fire alarm system and building automation system on damper actuator position end switches. Building automation system wiring to damper location will be provided by Mechanical Division.

3.1.13. 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 Where mechanical/sprinkler contractor makes revisions to the base design, electrical contractor shall coordinate any revisions to fire protection system directly with the mechanical/sprinkler contractor at no cost to the owner and update as-built drawings accordingly.

3.1.14. 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.

3.1.15. Connect fire suppression systems to control panel.

3.1.16. Splices in wiring are not permitted.

3.1.17. For audible and visual signal devices in spaces subject to future tenant renovations, install devices in surface mounted boxes and leave 3 m of extra wiring coiled up in the box to allow the devices to be lowered / relocated to suit the tenant fit up ceiling and wall locations.

3.1.18. Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and CCU, as required by equipment manufacturer.

3.1.19. Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

3.1.20. Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.

3.1.21. Install speakers and connect to speaker circuits.

3.1.22. 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.

3.1.23. Where devices are to be installed in environments where the temperature can drop below 0°C (or below the addressable device temperature rating), an appropriately rated conventional device is to be installed.

.1 Provide and install an addressable input module remotely located in a conditioned environment suitable for the device temperature rating.

.2 Connect the conventional device(s) to addressable input module(s) as necessary to monitor the status of the conventional device.

3.1.24. Where shown on Drawings, install “Fire do not enter signs” in accordance with the requirements of CAN/ULC-S524.

3.2. FIELD QUALITY CONTROL AND COMMISSIONING

3.2.1. Perform tests and verification in accordance with Section 26 08 01.00 - TECHNICAL SERVICES DIVISION STARTUP SERVICE.

3.2.2. The installing contractor is responsible for hiring and coordinating with the manufacturer to perform the following:

.1 Testing of system to CAN/ULC-S536 prior to performing verification.

.2 Partial verification inspection to CAN/ULC-S537 and reports as required for partial occupancy.

.3 Complete an entire building test to CAN/ULC-S536 and provide detailed report. Provide a full verification inspection and test report at the end of the project. Cumulative partial verification reports do not constitute a full verification.

3.2.3. 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.

3.3. LIFE SAFETY INTEGRATION TESTING

3.3.1. The fire alarm contractor and fire alarm manufacturer shall participate in the coordination and testing work associated with the Integrated Testing Plan (ITP), as described in more detail in Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS. All work shall be coordinated with the Integrated Testing Coordinator (ITC). The work shall include but not be limited to:

.1 Perform functional testing of the integration of all life safety and fire protection systems as a whole to ensure the proper operation and interconnection between the systems.

.2 Testing of the integrated life safety systems must be done as a complete installed assembly; individual component testing or partially installed assembly testing is not acceptable.

.3 Follow the testing methodology for verifying and documentation of operation as outlined in the ITP and in accordance with CAN/ULC-S1001.

.4 Provide fire alarm verification report along with all other documentation requested by the ITC as it relates to the electrical systems in conformance with CAN/ULC-S1001.

3.4. CENTRAL ALARM MONITORING

3.4.1. Locate Signal Transmitting Unit in same room as main fire alarm panel or in CACF room, unless shown otherwise on Drawings.

3.4.2. Provide a data connection from the Owner’s network for internet access for central monitoring.

3.4.3. Coordinate with the Owner’s Fire Alarm Monitoring Company and install power, conduit and wiring to the Signal Transmitting Unit in compliance with CAN/ULC-S559 and CAN/ULC S561.

3.4.4. Facilitate conversation between Owner and Owner’s preferred fire alarm central alarm monitoring service to ensure that central monitoring service is provided in time for completion of fire alarm scope and Project occupancy.

END OF SECTION