



SPECIFICATION (Issued for Construction, 04 November 2016)

Veterans Affairs Canada (VAC) Saskatoon Fit-Up Phase 2  
Public Works and Government Services Canada (PWGSC)  
Project No. R.080397.010

Federal Building  
Saskatoon, Saskatchewan



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**Part 1 General**

**1.1 WORK COVERED BY CONTRACT DOCUMENTS**

- .1 Work of this Contract is as indicated in the Contract Documents and summarized as follows:
  - .1 Demolition and removal of designated existing construction.
  - .2 New partitions, including finishes.
  - .3 Mechanical and electrical work.

**1.2 CONTRACT METHOD**

- .1 Division of the Work among Subcontractors, suppliers, or vendors is solely the Contractor's responsibility. The Departmental Representative assumes no responsibility to act as an arbiter to establish subcontract terms between sectors or disciplines of work.
- .2 Coordinate installation of Departmental Representative-supplied and vendor-supplied systems, and all associated equipment.

**1.3 PERMITS**

- .1 Consultant to apply for Building Permit.
- .2 Contractor to pick up and pay for Building Permit.

**1.4 WORK BY OTHERS**

- .1 Cooperate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative.
- .2 Coordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of Work.
- .3 Work of this Project must include provisions for co-ordinating related work, identified in Contract Documents, for following principal items.
  - .1 Coordinate with Shared Services Canada for IT connections and Work.
  - .2 Furniture installation.
  - .3 Refer to the Drawings.

**1.5 WORK SEQUENCE**

- .1 Coordinate with Departmental Representative Progress Schedule and Building Occupancy during construction.
- .2 Coordinate with Building Manager, requirements of ongoing Building Occupancy of other areas of the Buildings during construction.
  - .1 Provide sequence plan of operations and signage/partitions to be provided to allow ongoing Building Occupancy to the approval of the Building Manager prior to commencing the Work.
- .3 Maintain fire access/control.

**1.6 ALTERATIONS, ADDITIONS, OR REPAIRS TO EXISTING BUILDING**

- .1 Execute work with least possible interference or disturbance to building operations, occupants, public, and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.
- .2 Use only elevators existing in building for moving workers and material.
  - .1 Protect walls of passenger elevators, to approval of Departmental Representative, prior to use.
  - .2 Accept liability for damage, safety of equipment, and overloading of existing equipment.

**1.7 DOCUMENTS REQUIRED**

- .1 Successful bidding Contractor is to obtain required sets of Contract Documents for construction purposes, which includes two (2) sets for "as-built" and record purposes.
  - .1 Contractor is responsible for costs of printing, handling, and shipping of Contract Documents.
- .2 Maintain at job site, one copy each document as follows:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed Shop Drawings.
  - .5 List of Outstanding Shop Drawings.
  - .6 Change Orders.
  - .7 Other Modifications to Contract.
  - .8 Field Test Reports.
  - .9 Copy of Approved Work Schedule.
  - .10 Health and Safety Plan and Other Safety Related Documents.
  - .11 Other documents as specified.

**Part 2 Products**

Not used.

**Part 3 Execution**

Not used.

**END OF SECTION**

**Part 1 General**

**1.1 ACCESS AND EGRESS**

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

**1.2 USE OF SITE AND FACILITIES**

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work, provide temporary means to maintain security.
- .4 Deliver materials via loading dock wherever possible.
- .5 Use elevators existing in building for moving workers and material.
  - .1 Protect walls of passenger elevators, to approval of Departmental Representative, prior to use.
  - .2 Accept liability for damage, safety of equipment, and overloading of existing equipment.
- .6 Closures: Protect work temporarily until permanent enclosures are completed.

**1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING**

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

**1.4 EXISTING SERVICES**

- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, provide Departmental Representative 96 hours' notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions to a minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
- .3 Provide for personnel and pedestrian traffic.
- .4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

**1.5 SANITARY FACILITIES**

- .1 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.
- .2 Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.

**1.6 CONTRACTOR USE OF PREMISES**

- .1 Limit use of premises to allow:
  - .1 Partial building occupancy as defined by the Departmental Representative.
- .2 Co-ordinate use of premises under direction of Departmental Representative.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .4 Remove or alter existing work to prevent injury or damage to portions of existing work that remain.
- .5 Repair or replace portions of existing work that have been altered during construction operations to match existing or adjoining work, as directed by Department Representative.
- .6 At completion of operations condition of existing work to be equal to or better than that that existed before new work started.

**1.7 SPECIAL REQUIREMENTS**

- .1 Carry out noise generating Work Monday to Friday from 18:00 to 07:00 hours; provide 48 hours notice to Departmental Representative.
- .2 Deliver materials outside of peak traffic hours, 17:00 to 07:00; provide 48 hours notice to Departmental Representative.
- .3 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic, and security regulations.
- .4 Keep within limits of work and avenues of ingress and egress.
- .5 Ingress and egress of Contractor vehicles at site is limited to the loading dock, coordinate with Departmental Representative.

**1.8 SECURITY**

- .1 Where security has been reduced by Work of Contract, coordinate with Departmental Representative for security provision.
- .2 Personnel will be checked in daily at start of work shift and provided with pass that must be worn at all times. Pass must be returned at end of work shift and personnel checked out.
- .3 Personnel employed on this project must be escorted when executing work in all areas outside of regular business hours, which are typically Monday to Friday, 8:00 am to 4:30 pm.
- .4 Engage and pay for security for escort for personnel performing work in other tenant spaces, and when working outside of regular business hours.
  - .1 Right of first refusal for security provision is to be given to the Canadian Corps of Commissionaires.



**1.9 BUILDING SMOKING ENVIRONMENT**

- .1 Comply with smoking restrictions.
- .2 Smoking is not permitted inside building.
- .3 Confirm, with building management, outdoor locations where personnel may smoke.

**Part 2 Products**  
Not used.

**Part 3 Execution**  
Not used.

**END OF SECTION**

**Part 1            General**

**1.1            ADMINISTRATIVE**

- .1      Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
- .2      Prepare agenda for meetings.
- .3      Distribute written notice of each meeting four days in advance of meeting date to Departmental Representative.
- .4      Provide physical space and make arrangements for meetings.
- .5      Preside at meetings.
- .6      Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7      Reproduce and distribute copies of minutes within three days after meetings; transmit to meeting participants and affected parties not in attendance.
- .8      Representative of Contractor, subcontractors, and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

**1.2            PRECONSTRUCTION MEETING**

- .1      Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2      Senior representatives of Departmental Representative, Contractor, major subcontractors, field inspectors, and supervisors will be in attendance.
- .3      Establish time and location of meeting and notify parties concerned minimum five days before meeting.
- .4      Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5      Agenda to include:
  - .1      Appointment of official representative of participants in the Work.
  - .2      Schedule of Work: In accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart.
  - .3      Schedule of submission of shop drawings, samples, colour chips. Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .4      Requirements for temporary facilities, offices, utilities in accordance with Section 01 52 00 - Construction Facilities.
  - .5      Delivery schedule of specified equipment in accordance with Section 01 61 00 – Common Product Requirements.
  - .6      Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

- .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .8 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .10 Take-over procedures, acceptance, and warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .11 Monthly progress claims, administrative procedures, photographs, hold backs.
- .12 Appointment of inspection and testing agencies or firms.
- .13 Insurances, transcript of policies.

### **1.3 PROGRESS MEETINGS**

- .1 During course of Work and two weeks prior to project completion, schedule progress meetings bi-weekly.
- .2 Contractor, major subcontractors involved in Work, and Departmental Representative are to attend.
- .3 Notify parties minimum three days prior to meetings.
- .4 Record minutes of meetings; circulate to attending parties and affected parties not in attendance within three days after meeting.
- .5 Agenda to include the following:
  - .1 Review, approval of minutes of previous meeting.
  - .2 Review of Work progress since previous meeting.
  - .3 Field observations, problems, conflicts.
  - .4 Problems which impede construction schedule.
  - .5 Review of off-site fabrication delivery schedules.
  - .6 Corrective measures and procedures to regain projected schedule.
  - .7 Revision to construction schedule.
  - .8 Progress schedule, during succeeding work period.
  - .9 Review submittal schedules: expedite as required.
  - .10 Maintenance of quality standards.
  - .11 Review proposed changes for affect on construction schedule and on completion date.
  - .12 Other business.

### **Part 2 Products**

Not used.

**Part 3**            **Execution**  
Not used.

**END OF SECTION**

**Part 1 General****1.1 DEFINITIONS**

- .1 Activity: Element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): Graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally, Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: Original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: Number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: Summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: Significant event in project, usually completion of major deliverable.
- .8 Project Schedule: Planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: Overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

**1.2 REQUIREMENTS**

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate, and Final Certificate as defined times of completion are of essence of this contract.

**VAC Saskatoon Fit-Up Phase 2****CONSTRUCTION PROGRESS  
SCHEDULE – BAR (GANTT) CHART**

Saskatoon, Saskatchewan

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**1.3 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative within 5 working days of Award of Contract, Bar (GANTT) Chart as Master Plan for planning, monitoring, and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

**1.4 MASTER PLAN**

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within 5 working days.
- .3 Revise impractical schedule and resubmit within 5 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

**1.5 PROJECT SCHEDULE**

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
  - .1 Award.
  - .2 Shop Drawings, Samples.
  - .3 Permits.
  - .4 Mobilization.
  - .5 Interior Architecture (Walls, Floors, and Ceiling).
  - .6 Plumbing.
  - .7 Lighting.
  - .8 Electrical.
  - .9 Piping.
  - .10 Controls.
  - .11 Heating, Ventilating, and Air Conditioning.
  - .12 Millwork.
  - .13 Fire Systems.
  - .14 Testing and Commissioning.
  - .15 Supplied equipment long delivery items.
  - .16 Engineer-supplied equipment required dates.

**1.6 PROJECT SCHEDULE REPORTING**

- .1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

**1.7 PROJECT MEETINGS**

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

**Part 2 Products**

Not used.

**Part 3 Execution**

Not used.

**END OF SECTION**

**Part 1 General**

**1.1 ADMINISTRATIVE**

- .1 Provide submittals listed for review to Departmental Representative. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated, and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data that are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Where required, submit drawings stamped and signed by professional engineer registered or licensed in Saskatchewan.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross-references to design drawings and specifications.
- .4 Allow five days for Departmental Representative's review of each submission.



- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative, in writing, of revisions other than those requested.
- .7 Accompany submissions with transmittal letter containing:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification and quantity of each shop drawing, product data, and sample.
  - .5 Other pertinent data.
- .8 Submissions include:
  - .1 Date and revision dates.
  - .2 Project title and number.
  - .3 Name and address of:
    - .1 Subcontractor.
    - .2 Supplier.
    - .3 Manufacturer.
  - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
  - .5 Details of appropriate portions of Work as applicable:
    - .1 Fabrication.
    - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
    - .3 Setting or erection details.
    - .4 Capacities.
    - .5 Performance characteristics.
    - .6 Standards.
    - .7 Operating weight.
    - .8 Wiring diagrams.
    - .9 Single line and schematic diagrams.
    - .10 Relationship to adjacent work.
- .9 After Departmental Representative's review, distribute copies.
- .10 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .11 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental

- Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
    - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
    - .2 Testing must have been within 3 years of date of contract award for project.
  - .13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
    - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
    - .2 Certificates must be dated after award of project contract complete with project name.
  - .14 Submit electronic copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
    - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards, and safety precautions.
  - .15 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
  - .16 Submit documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
  - .17 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
  - .18 Delete information not applicable to project.
  - .19 Supplement standard information to provide details applicable to project.
  - .20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
  - .21 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.

- .1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
- .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

**1.3 SAMPLES**

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's business address.
- .3 Notify Departmental Representative in writing, at time of submission, of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern, or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples that Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

**1.4 MOCK-UPS**

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

**Part 2 Products**

Not used.

**Part 3 Execution**

Not used.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES AND CODES**

- .1      Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2      Meet or exceed requirements of:
  - .1          Contract documents.
  - .2          Specified standards, codes and referenced documents.

**1.2                HAZARDOUS MATERIAL DISCOVERY**

- .1      Asbestos: Demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Departmental Representative and obtain direction.
- .2      PCB: Polychlorinated Biphenyl: Stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Departmental Representative and obtain direction.
- .3      Mould: Stop work immediately when material resembling mould is encountered during demolition work. Notify Departmental Representative and obtain direction.

**1.3                BUILDING SMOKING ENVIRONMENT**

- .1      Comply with smoking restrictions and municipal by-laws. Smoking is not allowed inside building.

**Part 2            Products**

Not used.

**Part 3            Execution**

Not used.

**END OF SECTION**

**Part 1            General**

**1.1               INSPECTION**

- .1      Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2      Give timely notice requesting inspection if Work is designated for special tests, inspections, or approvals by Departmental Representative instructions, or law of Place of Work.
- .3      If Contractor covers, or permits to be covered, Work that has been designated for special tests, inspections, or approvals before they are made, uncover Work, have inspections or tests satisfactorily completed and make good Work.
- .4      Departmental Representative will order part of Work to be examined if it is suspected to be not in accordance with Contract Documents. If, upon examination, examined portion of Work is found not in accordance with Contract Documents, correct non-conforming work, and pay cost of examination and correction. If work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

**1.2               INDEPENDENT INSPECTION AGENCIES**

- .1      Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and testing portions of Work. Cost of such services will be borne by Departmental Representative.
- .2      Provide equipment required for executing inspection and testing by appointed agencies.
- .3      Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4      If defects are revealed during inspection and testing, appointed agency will request additional inspection and testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and re-inspection.

**1.3               ACCESS TO WORK**

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

**1.4               PROCEDURES**

- .1      Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

- .2 Submit samples and materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

### **1.5 REJECTED WORK**

- .1 Remove defective Work, whether result of poor work quality, use of defective products, or damage and whether incorporated in Work or not, that has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If, in opinion of Departmental Representative, it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

### **1.6 REPORTS**

- .1 Submit two copies of inspection and test reports to Departmental Representative.
- .2 Provide copies to subcontractor of work being inspected or tested.

### **1.7 TESTS AND MIX DESIGNS**

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

### **1.8 MOCK-UPS**

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections with requirements for provision of mock-ups.
- .2 Construct in locations acceptable to Departmental Representative.
- .3 Prepare mock-ups for Departmental Representative's review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 If requested, Departmental Representative will assist in preparing schedule-fixing dates for preparation.
- .6 Mock-ups may remain as part of Work.

**1.9 MILL TESTS**

- .1 Submit mill test certificates as requested.

**1.10 EQUIPMENT AND SYSTEMS**

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

**Part 2 Products**

Not used.

**Part 3 Execution**

Not used.

**END OF SECTION**

**Part 1        General**

**1.1        REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CAN/CSA S269.2-M1987 (R2003), Access Scaffolding for Construction Purposes.

**1.2        SUBMITTALS**

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

**1.3        INSTALLATION AND REMOVAL**

- .1 Indicate use of supplemental or other staging area.
- .2 Provide construction facilities in order to execute work expeditiously.
- .3 Remove from site all such work after use.

**1.4        SCAFFOLDING**

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

**1.5        ELEVATORS**

- .1 Designated existing elevators to be used by construction personnel and transporting of materials. Co-ordinate use with Departmental Representative.
- .2 Provide protective coverings for finish surfaces of elevator cars and entrances.

**1.6        SITE STORAGE/LOADING**

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

**1.7        CONSTRUCTION PARKING**

- .1 Parking will not be permitted on site.
- .2 Paid parking is available in the area nearby the site of Work, and is the Contractor's responsibility.

**1.8        CLEAN-UP**

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Store materials resulting from demolition activities that are salvageable.
- .3 Stack stored new or salvaged material not in construction facilities.



**Part 2            Products**

Not used.

**Part 3            Execution**

Not used.

**END OF SECTION**

**Part 1            General**

**1.1                INSTALLATION AND REMOVAL**

- .1      Provide temporary controls in order to execute Work expeditiously.
- .2      Remove from site all such work after use.

**1.2                DUST TIGHT SCREENS**

- .1      Provide dust tight screens or partitions to localize dust-generating activities, and for protection of workers, finished areas of Work, and public.
- .2      Ensure fire alarms and ventilation systems are not affected by dust-generating activities.
- .3      Maintain and relocate protection until such work is complete.
- .4      Coordinate location and security measures with Departmental Representative on Site.

**1.3                HOARDING**

- .1      Provide sturdy, stable hoarding where Work affects tenants or common walkways and access areas.

**1.4                FIRE ROUTES**

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

**1.5                PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY**

- .1      Protect surrounding private and public property from damage during performance of Work.
- .2      Be responsible for damage incurred.

**1.6                PROTECTION OF BUILDING FINISHES**

- .1      Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2      Provide necessary screens, covers, and hoardings.
- .3      Confirm with Departmental Representative locations and installation schedule three days prior to installation.
- .4      Be responsible for damage incurred due to lack of or improper protection.

**1.7                WASTE MANAGEMENT AND DISPOSAL**

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

Saskatoon, Saskatchewan

**Part 2          Products**

Not used.

**Part 3          Execution**

Not used.

**END OF SECTION**

**Part 1 General****1.1 REFERENCES**

- .1 Within text of each specifications section, reference may be made to reference standards. Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .2 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .3 Cost for such testing will be borne by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

**1.2 QUALITY**

- .1 Products, materials, equipment, and articles incorporated in Work are to be new, not damaged nor defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source, and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials, and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks, and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, and when located in mechanical or electrical rooms.

**1.3 STORAGE, HANDLING AND PROTECTION**

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration, soiling, and in accordance with manufacturer's instructions.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .6 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .7 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .8 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

#### **1.4 TRANSPORTATION**

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Departmental Representative will be paid by Departmental Representative. Unload, handle, and store such products.

#### **1.5 MANUFACTURER'S INSTRUCTIONS**

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

#### **1.6 QUALITY OF WORK**

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if conditions make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require incompetent or careless workers to be dismissed from site.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

**1.7 CO-ORDINATION**

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

**1.8 CONCEALMENT**

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

**1.9 REMEDIAL WORK**

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

**1.10 LOCATION OF FIXTURES**

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

**1.11 FASTENINGS**

- .1 Provide metal fastenings and accessories in same texture, colour, and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood and other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings that cause spalling or cracking of material to which anchorage is made are not acceptable.

**1.12 FASTENINGS - EQUIPMENT**

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified.

- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

**1.13 PROTECTION OF WORK IN PROGRESS**

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

**1.14 EXISTING UTILITIES**

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work and building occupants.
- .2 Protect, relocate, or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

**Part 2 Products**

Not used.

**Part 3 Execution**

Not used.

**END OF SECTION**

**Part 1            General**

**1.1                EXISTING SERVICES**

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

**1.2                LOCATION OF EQUIPMENT AND FIXTURES**

- .1        Location of equipment, fixtures, and outlets indicated or specified are to be considered as approximate.
- .2        Locate equipment, fixtures, and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3        Inform Departmental Representative of impending installation and obtain approval for actual location.
- .4        Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

**Part 2            Products**

Not used.

**Part 3            Execution**

Not used.

**END OF SECTION**



**Part 1            General**

**1.1            SUBMITTALS**

- .1      Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Submit written request in advance of cutting or alteration which affects:
  - .1          Structural integrity of elements of project.
  - .2          Integrity of weather-exposed or moisture-resistant elements.
  - .3          Efficiency, maintenance, or safety of operational elements.
  - .4          Visual qualities of sight-exposed elements.
  - .5          Work of separate contractor.
- .3      Include in request:
  - .1          Identification of project.
  - .2          Location and description of affected Work.
  - .3          Statement on necessity for cutting or alteration.
  - .4          Description of proposed Work, and products to be used.
  - .5          Alternatives to cutting and patching.
  - .6          Effect on Work of separate contractors.
  - .7          Written permission of affected separate contractors.
  - .8          Date and time work will be executed.

**1.2            PREPARATION**

- .1      Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2      After uncovering, inspect conditions affecting performance of Work.
- .3      Beginning of cutting or patching means acceptance of existing conditions.
- .4      Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5      Provide protection from elements for areas that are to be exposed by uncovering work.

**1.3            EXECUTION**

- .1      Execute cutting, fitting, and patching to complete Work.
- .2      Fit several parts together, to integrate with other Work.
- .3      Uncover Work to install ill-timed Work.
- .4      Remove and replace defective and non-conforming Work.
- .5      Remove samples of installed Work for testing if required.
- .6      Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

- .7 Execute Work by methods to avoid damage to other Work, and to provide proper surfaces to receive patching and finishing.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools are not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material in accordance with Section 07 84 00 – Firestopping, full thickness of the construction element.
- .12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .13 Conceal pipes, ducts and wiring in floor, wall, and ceiling construction of finished areas except where indicated otherwise.

**1.4 WASTE MANAGEMENT AND DISPOSAL**

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

**Part 2 Products**

Not used.

**Part 3 Execution**

Not used.

**END OF SECTION**

**Part 1 General**

**1.1 PROJECT CLEANLINESS**

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

**1.2 FINAL CLEANING**

- .1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.

- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Wax, seal, shampoo, or prepare floor finishes, as recommended by manufacturer.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Broom clean and wash exterior walks, steps and surfaces.
- .14 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .15 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

**1.3 WASTE MANAGEMENT AND DISPOSAL**

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

**Part 2 Products**

Not used.

**Part 3 Execution**

Not used.

**END OF SECTION**

**Part 1 General**

**1.1 STORAGE, HANDLING AND PROTECTION**

- .1 Store materials to be reused in locations as directed by Departmental Representative.
- .2 Unless specified otherwise, materials for removal become Contractor's property.
- .3 Protect structural components not removed for demolition from movement or damage.
- .4 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.
- .5 Protect surface drainage, mechanical, and electrical from damage and blockage.

**1.2 DISPOSAL OF WASTES**

- .1 Refer to Section 01 14 00 – Work Restrictions for waste handling restrictions.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil, nor paint thinner into waterways, storm, or sanitary sewers.
- .3 Remove waste materials as deconstruction/disassembly Work progresses.

**Part 2 Products**

Not used.

**Part 3 Execution**

**3.1 APPLICATION**

- .1 Handle waste materials in accordance with appropriate regulations and codes.

**3.2 CLEANING**

- .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.

**3.3 DIVERSION OF MATERIALS**

- .1 On-site sale of salvaged, recovered, reusable, and recyclable material is not permitted.

**END OF SECTION**

**Part 1 General**

**1.1 ADMINISTRATIVE REQUIREMENTS**

- .1 Acceptance of Work Procedures:
  - .1 Contractor's Inspection:
    - .1 Conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
    - .2 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
    - .3 Request Departmental Representative inspection.
  - .2 Departmental Representative Inspection:
    - .1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
    - .2 Correct Work as directed.
  - .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
    - .1 Work: Completed and inspected for compliance with Contract Documents.
    - .2 Defects: Corrected and deficiencies completed.
    - .3 Equipment and systems: Tested, adjusted, balanced, and fully operational.
    - .4 Certificates required by Boiler Inspection Branch, Fire Commissioner, Utility companies: submitted.
    - .5 Operation of systems: Demonstrated to Building Operations personnel.
    - .6 Commissioning of mechanical systems: Completed in accordance with 01 91 13 - General Commissioning (Cx) Requirements and copies of final Commissioning Report submitted to Departmental Representative.
    - .7 Work: Complete and ready for final inspection.
  - .4 Final Inspection:
    - .1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.
    - .2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

**1.2 FINAL CLEANING**

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

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

**Part 2 Products**

Not used.

**Part 3 Execution**

Not used.

**END OF SECTION**

**Part 1        General**

**1.1        ADMINISTRATIVE REQUIREMENTS**

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

**1.2        SUBMITTALS**

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

**1.3        O & M MANUALS - FORMAT**

- .1    Organize data as instructional manual.
- .2    Binders: Vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3    When multiple binders are used correlate data into related consistent groupings.
  - .1    Identify contents of each binder on spine.
- .4    Cover and Spine:
  - .1    Building name.
  - .2    Address.
  - .3    Project name.



- .4 Project number – (GOC#).
- .5 Date completed.
- .5 Title page: “O & M Manual for:”
  - .1 Building name.
  - .2 Address.
  - .3 Date.
  - .4 General Contractor information: Name, address, phone number.
  - .5 Consultant: Name, address, phone number.
- .6 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .7 Index and tabs:
  - .1 Provide dividers with permanently marked tabs to separate each section and subsection.
  - .2 Provide main tab for each major specification section.
- .8 Provide tabs as follows:
  - .1 Tab A: Warranties as specified in this section.
  - .2 Tab B: Contact information for all sub-contractors and suppliers, including:
    - .1 Name, address, phone number of manufacturer and installing contractor.
    - .2 24 hour emergency service contact for all equipment, identified by equipment.
  - .3 Tab C: Report and Permits
    - .1 TAB reports.
    - .2 Pre-functional tests.
    - .3 Start-up reports.
    - .4 Completed performance verification forms.
    - .5 Cabling verifications.
    - .6 ESA certification.
    - .7 TSSA certification.
    - .8 Fire alarm certifications.
    - .9 All permits, including electrical, building, plumbing, etc.
  - .4 Tab D: As-built drawings as specified in this section.
  - .5 Tab E:
    - .1 Sequence of operation: Outline of how systems installed are designed to work.
    - .2 Accurate sequence of operation, with detailed instruction in proper sequence, for each mode of operation.
    - .3 Emergency operation: Functions of equipment that can be operated while other functions disabled. Include only for alternate

- abnormal operations that can follow when there is partial failure, malfunctioning of components, or other unusual condition.
  - .4 Shutdown procedure: Instructions for stopping and securing equipment after operations. Indicate particular sequence requirements, with step-by-step instructions in order.
- .6 Tab F: CMMS Data Sheets
  - .1 Complete and include CMMS inventory sheet for all equipment deleted, removed, added, and replaced.
- .7 Tab G: Shop drawings:
  - .1 Copies of all Consultant-reviewed shop drawings.
- .8 Tab H:
  - .1 Specific service and maintenance manuals. Include preventative and corrective maintenance, with service procedures and schedules.
  - .2 Preventative maintenance schedule in printed format and electronic format, compatible with Owner's system.
  - .3 Recommended frequency of performance for each preventative maintenance task, cleaning, inspection, and scheduled overhauls or reconditioning.
  - .4 Cleaning: Instructions and schedules for all routine cleaning and recommended inspection, including recommended cleaners and lubricants.
  - .5 Inspection: Periodic inspection of equipment required for operation, cleaning, or other reasons, indicating items to be inspected and criteria given for motors, controls, filters, and other maintenance items.
  - .6 Instructions for minor repairs and adjustments required for preventative maintenance routines.
  - .7 List of special tools required to service and maintain equipment.
- .9 Tab I: Miscellaneous items:
  - .1 Health and safety submittals, including site-specific hazard assessment, safety manual TOC, and company safety policy, MSDS sheets, signed site orientations for worker, copy of first aid certificate, copy of emergency plan and muster location.
  - .2 Special requirements for equipment, not to be used for reports.
- .9 Text: Manufacturer's printed data, or typewritten data.
- .10 Drawings: Provide with reinforced punched binder tab.
  - .1 Bind in with text; fold larger drawings to size of text pages.
- .11 Provide 1:1 scaled CAD files in dwg format on CD/DVD.

#### **1.4 AS-BUILT DOCUMENTS AND SAMPLES**

- .1 Maintain at site, for Departmental Representative, one record copy of:
  - .1 Contract Drawings.

- .2 Specifications.
- .3 Addenda.
- .4 Change Orders and other modifications to Contract.
- .5 Reviewed shop drawings, product data, and samples.
- .6 Field test records.
- .7 Inspection certificates.
- .8 Manufacturers' certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
  - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
  - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry, and legible condition.
  - .1 Do not use record documents for construction purposes.
- .5 Submit as-built drawings to Departmental Representative.
  - .1 Provide in electronic form as CAD .dwg format, on CD/DVD.
- .6 Keep record documents and samples available for inspection by Departmental Representative.

## **1.5 AS-BUILT AND RECORD DOCUMENTS**

- .1 Record information on drawings and in designated copy of Project Manual provided by Departmental Representative.
- .2 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .3 Use red felt tip marking pens.
- .4 Mark on one set of prints and at completion of project and prior to final inspection; neatly transfer notations to second set.
- .5 Incorporate as-built information into CAD drawings.
- .6 Maintain information on project site drawings and record accurately, deviations of newly installed or existing works from Contract documents during construction.
- .7 Ensure but do not limit recording of following information on original as-built drawings:
  - .1 Locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.
  - .2 Changes made by Change Order.
  - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
  - .4 Field changes of dimension and detail.
  - .5 Details not on original Contract Drawings.

- .6 References to related shop drawings and modifications.
- .8 Specifications: mark each item to record actual construction, including:
  - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
  - .2 Changes made by Addenda and change orders.
- .9 At substantial completion of project and prior to final inspection, submit as-built drawings and project manual to Departmental Representative.
  - .1 Departmental Representative will review and initial, to concur with content of the final mark-ups.
- .10 Transcribe as-built information to record drawings based on Contractor's site records.

## **1.6 MATERIALS AND FINISHES**

- .1 Building products, applied materials, and finishes: Include product data, with catalogue number, size, composition, and colour and texture designations.
  - .1 Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and weather-exposed products: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional requirements: As specified in individual specifications sections.

## **1.7 MAINTENANCE MATERIALS**

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

- .2 Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 Special Tools:
  - .1 Provide special tools, in quantities specified in individual specification section.
  - .2 Provide items with tags identifying their associated function and equipment.
  - .3 Deliver to site; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Departmental Representative.
    - .2 Include approved listings in Maintenance Manual.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Departmental Representative.

## **1.9 WARRANTIES AND BONDS**

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .6 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Departmental Representative.
- .7 Include information contained in warranty management plan as follows:
  - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.

- .2 Provide list for each warranted equipment, item, feature of construction, or system, indicating:
  - .1 Name of item.
  - .2 Model and serial numbers.
  - .3 Location where installed.
  - .4 Name and phone numbers of manufacturers or suppliers.
  - .5 Names, addresses, and telephone numbers of sources of spare parts.
  - .6 Warranties and terms of warranty: Include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
  - .7 Cross-reference to warranty certificates as applicable.
  - .8 Starting point and duration of warranty period.
  - .9 Summary of maintenance procedures required to continue warranty in force.
  - .10 Cross-reference to specific pertinent Operation and Maintenance manuals.
  - .11 Organization, names, and phone numbers of persons to call for warranty service.
  - .12 Typical response time and repair time expected for various warranted equipment.
- .3 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.
- .4 Procedure and status of tagging of equipment covered by extended warranties.
- .5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .8 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .9 Written verification to follow oral instructions.
  - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

#### **1.10 WARRANTY TAGS**

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

- .4 Contract number.
- .5 Warranty period.
- .6 Inspector's signature.
- .7 Construction Contractor.

**Part 2        Products**  
Not used.

**Part 3        Execution**  
Not used.

**END OF SECTION**

## Brookfield Global Integrated Solutions - Equipment Data Collection Form (DCF) - Ver 1.2

ONLY EQUIPMENT THAT BROOK FIELD GIS IS RESPONSIBLE TO PERFORM PLANNED MAINTENANCE SHOULD BE RECORDED

### GENERAL INFORMATION

Subm Date (Sep 22, 2010): \_\_\_\_\_

Project #: \_\_\_\_\_

CBG (ex: TD, CIBC, etc) \*\*: \_\_\_\_\_

Requester Name \*\*: \_\_\_\_\_

Client Building #: \_\_\_\_\_

Requesters Phone #: \_\_\_\_\_

Building #: \_\_\_\_\_

Building Address: \_\_\_\_\_

All O&M Binders should be submitted to the FM. Pdf versions can be submitted with this form to be stored on the Brookfield GIS Portal

\*\* denotes mandatory field

### EQUIPMENT INFORMATION

☐ Add Equipment ☐ Replace Old Equipment ☐ Update Equipment ☐ Inactivate Equipment (info retained)

Current Building Item ID# (if known): \_\_\_\_\_ Criticality (1-Critical, 2-Minimal Impact, 3-Non-Critical): \_\_\_\_\_

Building Item (Equip) Description \*\*: \_\_\_\_\_

Belongs to Equipment ID: \_\_\_\_\_

Specific Location of Equip \*\*: \_\_\_\_\_

What does this equipment service? (ex: Air Conditioning Unit serving LAN Room) \_\_\_\_\_

System Type (2 digits): \_\_\_\_\_

Building Item Type (3 digits): \_\_\_\_\_

Client ID#: \_\_\_\_\_

Manufacturer Name: \_\_\_\_\_

Model: \_\_\_\_\_

Serial #: \_\_\_\_\_

**Note: These fields are mandatory for all HVAC products containing refrigerant \*\***

Tonnage: \_\_\_\_\_

Ref Capacity (kg): \_\_\_\_\_

Refrigerant Type: \_\_\_\_\_

ODP Tag #: \_\_\_\_\_

ODP Tag Date: \_\_\_\_\_

### WARRANTY INFORMATION \*\*

Warrantor Name: \_\_\_\_\_ Install Date: \_\_\_\_\_

Warranty/Terms: \_\_\_\_\_ Warranty Expiry Date: \_\_\_\_\_

Estimate Service Life (Years): \_\_\_\_\_ Purchase Price (without tax): \_\_\_\_\_

### SPECIFIC EQUIPMENT INFORMATION

Volts: \_\_\_\_\_ Phase: \_\_\_\_\_ FLA: \_\_\_\_\_

Filter Size (hwxthk): \_\_\_\_\_ Belt Size: \_\_\_\_\_ HP/Watt: \_\_\_\_\_

Filter Quantity: \_\_\_\_\_ Belt Quantity: \_\_\_\_\_ BTU/Watt: \_\_\_\_\_

Energy Source: ☐ NATURAL GAS ☐ OIL ☐ PROPANE ☐ ELECTRIC

### REQUESTER COMMENTS

### PM SCHEDULING INFORMATION (Optional)

Please fill in date Annual should be performed in as well as any service provider if known

Service Provider 1: \_\_\_\_\_ First Date: \_\_\_\_\_ Frequency: \_\_\_\_\_ \*\*\*

Service Provider 2: \_\_\_\_\_ First Date: \_\_\_\_\_ Frequency: \_\_\_\_\_ \*\*\*

Service Provider 3: \_\_\_\_\_ First Date: \_\_\_\_\_ Frequency: \_\_\_\_\_ \*\*\*

\*\*\* Available: Daily, Weekly, Bi-Weekly (every 2 wks), Monthly, Bi-Monthly (every 2 mos), Quarterly, Semi-Annual, Annual, 2 Year, 3 Year, 5 Year, 6 Year, 10 Year, 12 Year, 15 Year

Return all completed forms to GOC.CMMS@Brookfieldgis.com, enter the region in the subject line of the email



**Part 1 General**

**1.1 ADMINISTRATIVE REQUIREMENTS**

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to building operations personnel two weeks prior to date of substantial performance.
- .2 Departmental Representative: Provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- .3 Preparation:
  - .1 Verify that conditions for demonstration and instructions comply with requirements.
  - .2 Verify designated personnel are present.
  - .3 Ensure testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements, and that equipment and systems are fully operational.
- .4 Demonstration and Instructions:
  - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the equipment location.
  - .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
  - .3 Review contents of manual in detail to explain aspects of operation and maintenance.
  - .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

**1.2 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration, with list of persons present.
- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

**1.3 QUALITY ASSURANCE**

- .1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:

- .1 Instruct building operations personnel.
- .2 Provide written report that demonstration and instructions have been completed.

**Part 2 Products**

Not used.

**Part 3 Execution**

Not used.

**END OF SECTION**

# Commissioning Oversight Training & Orientation Record

Document Number:	COMM 304 02
Revision Date:	1/6/2016
Revision #:	1
Page #:	1 of 1

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Portfolio	Portfolio Name	Date
		August 2, 2016
Building ID	Building Name	
Project #	Project Name	
GOC		

Trainer's Name	Company	Position/Qualifications

Participant's Name	Job Title	Initials

Brookfield GIS Commissioning Oversight Manager/Specialist	Signature	Date

**Part 1 General**

**1.1 REFERENCES**

- .1 CSA Z320-11 – Building Commissioning Standard.

**1.2 SUMMARY**

- .1 Section Includes:
  - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to functional performance testing of components, equipment, sub-systems, systems, and integrated systems.
- .2 Acronyms:
  - .1 CO<sub>2</sub> – Carbon dioxide.
  - .2 CWS – Cold Water System.
  - .3 Cx - Commissioning.
  - .4 EMCS - Energy Management Control System.
  - .5 FPT – Functional Performance Testing.
  - .6 HWS – Hot Water System.
  - .7 O & M - Operation and Maintenance.
  - .8 OPT – Optimization.
  - .9 SOM – System Operation Manual.
  - .10 TAB - Testing, Adjusting, and Balancing.

**1.3 GENERAL**

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Functional Performance Testing responsibilities have been completed and approved. Objectives:
  - .1 Verify installed equipment, systems, and integrated systems operate in accordance with contract documents and design criteria and intent.
  - .2 Ensure appropriate documentation is compiled in the SOM.
  - .3 Effectively train O & M staff.
- .2 Contractor to assist in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
  - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.

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- .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .3 Design Criteria: To client's requirements or determined by designer. To meet Project functional and operational requirements.

#### **1.4 COMMISSIONING OVERVIEW**

- .1 Section 01 91 31 - Commissioning (Cx) Plan.
- .2 For Cx responsibilities refer to Section 01 91 31 - Commissioning (Cx) Plan.
- .3 Cx to be a line item of Contractor's cost breakdown.
- .4 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.
- .6 Departmental Representative will issue Interim Acceptance Certificate when:
  - .1 Completed Cx documentation has been received and reviewed for suitability by Departmental Representative.
  - .2 Equipment, components and systems have been commissioned.
  - .3 O & M training has been completed.

#### **1.5 NON-CONFORMANCE TO FUNCTIONAL PERFORMANCE REQUIREMENTS**

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the non-functional system, including related systems as deemed required by Departmental Representative, to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor.

#### **1.6 PRE-CX REVIEW**

- .1 Before Construction:
  - .1 Review contract documents, confirm by writing to Departmental Representative.
    - .1 Adequacy of provisions for Cx.
    - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
  - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:

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- .1 Have completed Cx Plan up-to-date.
  - .2 Ensure installation of related components, equipment, sub-systems, and systems is complete.
  - .3 Fully understand Cx requirements and procedures.
  - .4 Have Cx documentation shelf-ready.
  - .5 Understand completely design criteria and intent and special features.
  - .6 Submit complete start-up documentation to Departmental Representative.
  - .7 Have Cx schedules up-to-date.
  - .8 Ensure systems have been cleaned thoroughly.
  - .9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.
  - .10 Ensure "As-Built" system schematics are available.
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

#### **1.7 CONFLICTS**

- .1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

#### **1.8 SUBMITTALS**

- .1 Submittals: In accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit no later than 4 weeks after award of Contract:
    - .1 Name of Contractor's Cx agent.
    - .2 Draft Cx documentation.
    - .3 Preliminary Cx schedule.
  - .2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
  - .3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 8 weeks prior to start of Cx.
  - .4 Provide additional documentation relating to Cx process required by Departmental Representative.

#### **1.9 COMMISSIONING DOCUMENTATION**

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms for requirements and instructions for use.
- .2 Departmental Representative to review and approve Cx documentation.

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- .3 Provide completed and approved Cx documentation to Departmental Representative.

#### **1.10 COMMISSIONING SCHEDULE**

- .1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart. Update schedule as necessary during the work to reflect progress on components and systems.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
  - .1 Approval of Cx reports.
  - .2 Verification of reported results.
  - .3 Repairs, retesting, re-commissioning, re-verification.
  - .4 Training.

#### **1.11 COMMISSIONING MEETINGS**

- .1 Convene Cx meetings following project meetings: Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart and as specified.
- .2 Purpose: Resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage, Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
  - .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
  - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Contractor, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

#### **1.12 STARTING AND TESTING**

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

#### **1.13 WITNESSING OF STARTING AND TESTING**

- .1 Provide 14 days notice prior to commencement.

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- .2 Departmental Representative to witness of start-up and testing.
- .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

#### **1.14 MANUFACTURER'S INVOLVEMENT**

- .1 Factory testing: Manufacturer to:
  - .1 Coordinate time and location of testing.
  - .2 Provide testing documentation for approval by Departmental Representative.
  - .3 Arrange for Departmental Representative to witness tests.
  - .4 Obtain written approval of test results and documentation from Departmental Representative before delivery to site.
- .2 Obtain manufacturers' installation, start-up, and operations instructions and review with Departmental Representative prior to start-up of components, equipment, and systems.
  - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
  - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .3 Integrity of warranties:
  - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
  - .2 Verify with manufacturer that testing as specified will not void warranties.
- .4 Qualifications of manufacturer's personnel:
  - .1 Experienced in design, installation, and operation of equipment and systems.
  - .2 Ability to interpret test results accurately.
  - .3 To report results in clear, concise, logical manner.

#### **1.15 PROCEDURES**

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
  - .1 Included in delivery and installation:
    - .1 Verification of conformity to specification, approved shop drawings and completion of static verification report forms.
    - .2 Visual inspection of quality of installation.
  - .2 Start-up: Follow accepted start-up procedures.
  - .3 Operational testing: Document equipment performance.
  - .4 System FPT: Include repetition of tests after correcting deficiencies.



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- .5 Post-substantial FPT: Include fine-tuning.
- .3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
- .4 Document required tests on approved FPT forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
  - .1 Minor equipment/systems: Implement corrective measures approved by Departmental Representative.
  - .2 Major equipment/systems: If evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
  - .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
    - .1 Rejected equipment to be remove from site and replace with new.
    - .2 Subject new equipment/systems to specified start-up procedures.

#### **1.16 START-UP DOCUMENTATION**

- .1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.
- .2 Start-up documentation to include:
  - .1 Factory and on-site test certificates for specified equipment.
  - .2 Pre-start-up inspection reports.
  - .3 Signed installation/start-up check lists.
  - .4 Start-up reports.
  - .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

#### **1.17 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS**

- .1 After start-up, operate, and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer, develop written maintenance program and submit Departmental Representative for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

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**1.18 TEST RESULTS**

- .1 If start-up, testing, or FPT produce unacceptable results, repair, replace, or repeat specified starting or FPT procedures until acceptable results are achieved.
- .2 Provide labour and materials, assume costs for re-commissioning.

**1.19 START OF COMMISSIONING**

- .1 Notify Departmental Representative at least 21 days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and functional performance testing of systems have been completed.

**1.20 INSTRUMENTS / EQUIPMENT**

- .1 Submit to Departmental Representative for review and approval:
  - .1 Complete list of instruments proposed to be used.
  - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date, and calibration accuracy.
- .2 Provide the following equipment as required:
  - .1 2-way radios.
  - .2 Ladders.
  - .3 Equipment as required to complete work.

**1.21 COMMISSIONING FUNCTIONAL PERFORMANCE TESTING**

- .1 Carry out Cx:
  - .1 Under actual operating conditions, over entire operating range, in all modes.
  - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 EMCS trending to be available as supporting documentation for FPT.

**1.22 WITNESSING COMMISSIONING**

- .1 Departmental Representative to witness activities and verify results.

**1.23 AUTHORITIES HAVING JURISDICTION**

- .1 Where specified start-up, testing, or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance, and compliance with rules and regulation of authority having jurisdiction.

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- .3 Provide copies to Departmental Representative within 5 days of test, with Cx report.

#### **1.24 COMMISSIONING CONSTRAINTS**

- .1 Since access into secure or sensitive areas will be very difficult after occupancy it is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems in these areas before issuance of the Interim Certificate, using, if necessary, simulated thermal loads.

#### **1.25 EXTRAPOLATION OF RESULTS**

- .1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

#### **1.26 EXTENT OF VERIFICATION**

- .1 Provide labour and instrumentation to verify up to 30% of reported results, unless specified otherwise in other sections.
- .2 Number and location to be at discretion of Departmental Representative.
- .3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment and instrumentation.
- .4 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.
- .5 Perform additional commissioning until results are acceptable to Departmental Representative.

#### **1.27 REPEAT VERIFICATIONS**

- .1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:
  - .1 Verification of reported results fail to receive Departmental Representative's approval.
  - .2 Repetition of second verification again fails to receive approval.
  - .3 Departmental Representative deems Contractor's request for second verification was premature.

#### **1.28 SUNDRY CHECKS AND ADJUSTMENTS**

- .1 Make adjustments and changes that become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

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**1.29 DEFICIENCIES, FAULTS, DEFECTS**

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.
- .2 Report problems, faults, and defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

**1.30 COMPLETION OF COMMISSIONING**

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

**1.31 ACTIVITIES UPON COMPLETION OF COMMISSIONING**

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

**1.32 TRAINING**

- .1 In accordance with Section 01 91 41 - Commissioning (Cx) - Training.

**1.33 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS**

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

**1.34 OCCUPANCY**

- .1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

**1.35 INSTALLED INSTRUMENTATION**

- .1 Use instruments installed under Contract for OPT and FPT if:
  - .1 Accuracy complies with these specifications.
  - .2 Calibration certificates have been deposited with Departmental Representative.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

**1.36 FUNCTIONAL PERFORMANCE TESTING TOLERANCES**

- .1 Application tolerances:
  - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.

- .2 Instrument accuracy tolerances:
  - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
  - .1 Unless otherwise specified actual values to be within +/- 2 % of recorded values.

**1.37 OWNER'S PERFORMANCE TESTING**

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

**Part 2 Products**

Not Used.

**Part 3 Execution**

Not Used.

**END OF SECTION**

## **Part 1 General**

### **1.1 SUMMARY**

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

### **1.2 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CSA Z320-11, Building Commissioning.
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 13-2007, Installation of Sprinkler Systems.
  - .2 NFPA 14-2007, Installation of Standpipe and Hose Systems.
  - .3 NFPA 20-2007, Installation of Stationary Pumps for Fire Protection.
- .3 Underwriters' Laboratories of Canada (ULC)

### **1.3 GENERAL**

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

- .3 Process and methodology for successful Cx.
- .4 Acronyms:
  - .1 CO2 – Carbon dioxide.
  - .2 CWS – Cold Water Systems.
  - .3 Cx - Commissioning.
  - .4 EMCS - Energy Monitoring and Control Systems.
  - .5 FPT – Functional Performance Testing.
  - .6 HVAC – Heating, Ventilation, and Air Conditioning.
  - .7 HWS – Hot Water System.
  - .8 MSDS - Material Safety Data Sheets.
  - .9 OPT – Optimization.
  - .10 SOM – System Operation Manual.
  - .11 TAB - Testing, Adjusting and Balancing.
  - .12 VOC – Volatile Organic Compound.
  - .13 WHMIS - Workplace Hazardous Materials Information System.
- .5 Commissioning terms used in this Section:
  - .1 Bumping: short term start-up to prove ability to start and prove correct rotation.
  - .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

#### **1.4 DEVELOPMENT OF 100% CX PLAN**

- .1 Cx Plan to be 95% completed before being added into Project Specifications.
- .2 Cx Plan to be 100% completed within 8 weeks of award of contract to take into account:
  - .1 Approved shop drawings and product data.
  - .2 Approved changes to contract.
  - .3 Contractor's project schedule.
  - .4 Cx schedule.
  - .5 Contractor's, sub-contractor's, suppliers' requirements.
  - .6 Project construction team's and Cx team's requirements.
- .3 Submit completed Cx Plan for review and further obtain Departmental Representative's written approval.

#### **1.5 REFINEMENT OF CX PLAN**

- .1 During construction phase, revise, refine and update Cx Plan to include:
  - .1 Changes resulting from Client program modifications.
  - .2 Approved design and construction changes.
- .2 Revise, refine, and update every 6 weeks during construction phase. At each revision, indicate revision number and date.

- .3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.
- .4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

## **1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM**

- .1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.
- .2 Project Manager will select Cx Team consisting of following members:
  - .1 PWGSC Design Quality Review Team: During construction, will conduct periodic site reviews to observe general progress.
  - .2 PWGSC Quality Assurance Commissioning Manager: Ensures Cx activities are carried out to ensure delivery of a fully operational project including:
    - .1 Review of Cx documentation from operational perspective.
    - .2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
    - .3 Protection of health, safety, and comfort of occupants and O & M personnel.
    - .4 Monitoring of Cx activities, training, development of Cx documentation.
    - .5 Work closely with members of Cx Team.
  - .3 Departmental Representative is responsible for:
    - .1 Organizing Cx.
    - .2 Monitoring operations Cx activities.
    - .3 Witnessing, certifying accuracy of reported results.
    - .4 Witnessing and certifying TAB and other tests.
    - .5 Developing SOM.
    - .6 Ensuring implementation of final Cx Plan.
    - .7 Performing verification of performance of installed systems and equipment.
    - .8 Implementation of Training Plan.
  - .4 Construction Team: Contractor, sub-contractors, suppliers, and support disciplines; is responsible for construction/installation in accordance with contract documents, including:
    - .1 Testing.
    - .2 OPT.
    - .3 Performance of Cx activities.
    - .4 Delivery of training and Cx documentation.
    - .5 Assigning one person as point of contact with Consultant and PWGSC Cx Manager for administrative and coordination purposes.



- .5 Contractor's Cx agent implements specified Cx activities including:
  - .1 Revise, refine and update CX plan.
  - .2 Demonstrations.
  - .3 Training.
  - .4 Testing.
  - .5 Preparation, submission of test reports.
- .6 Property Manager: Represents lead role in Operation Phase and onwards and is responsible for:
  - .1 Receiving facility.
  - .2 Day-to-day operation and maintenance of facility.

## **1.7 CX PARTICIPANTS**

- .1 Employ the following Cx participants to verify performance of equipment and systems:
  - .1 Installation contractor/subcontractor:
    - .1 Equipment and systems except as noted.
  - .2 Equipment manufacturer: Equipment specified to be installed and started by manufacturer.
    - .1 Include FPT.
  - .3 Specialist subcontractor: Equipment and systems supplied and installed by specialist subcontractor.
  - .4 Specialist Cx agency:
    - .1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.
  - .5 Client: Responsible for intrusion and access security systems.
- .2 Ensure that Cx participant:
  - .1 Could complete work within scheduled time frame.
  - .2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O & M personnel, including:
    - .1 Modify ventilation rates to meet changes in off-gassing.
    - .2 Changes to heating or cooling loads beyond scope of EMCS.
    - .3 Changes to EMCS control strategies beyond level of training provided to O & M personnel.
    - .4 Redistribution of electrical services.
    - .5 Modifications of fire alarm systems.
    - .6 Modifications to voice communications systems.
- .3 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

## **1.8 EXTENT OF CX**

- .1 The following list outlines the extent of Cx.
  - .1 Structural and Architectural systems:
    - .1 Doors, related hardware:
      - .1 New door hardware.
  - .2 Mechanical systems and associated equipment:
    - .1 Plumbing systems:
      - .1 Domestic CWS and HWS.
      - .2 Regular sanitary waste systems.
    - .2 HVAC and exhaust systems:
      - .1 HVAC systems.
      - .2 General exhaust systems.
      - .3 Heat recovery systems.
      - .4 Smoke control systems installed in contract.
  - .3 Fire and life safety systems:
    - .1 Special fire suppression systems.
    - .2 Fire pumps, including transfer switches and controllers.
    - .3 Wet pipe sprinkler systems.
    - .4 Dry pipe sprinkler systems.
    - .5 Standpipe and hose systems.
    - .6 Total flooding fire extinguishing systems.
    - .7 Fire extinguishers.
  - .4 EMCS.
- .3 Commission electrical systems and equipment:
  - .1 Low voltage below 750 V:
    - .1 Low voltage equipment.
    - .2 Low voltage distribution systems.
    - .3 Electronic data and communications information systems.
  - .2 Emergency power generation systems:
    - .1 Uninterruptible power systems.
  - .3 Lighting systems:
    - .1 Lighting equipment.
    - .2 Distribution systems.
    - .3 Emergency lighting systems, including battery packs.
    - .4 Fire exit emergency signage.
  - .4 Fire alarm systems, equipment:
    - .1 Annunciators.
    - .2 Control panels.
    - .3 Fire alarm battery banks.
  - .5 Other systems and equipment:

- .1 Intrusion and access security and safety systems:
  - .1 Intrusion alarm system.
  - .2 Electronic door access control system.
  - .3 Video surveillance system.
- .2 Sound masking system.
- .3 Lightning protection systems.

## **1.9 DELIVERABLES RELATING TO O & M PERSPECTIVES**

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

## **1.10 DELIVERABLES RELATING TO THE CX PROCESS**

- .1 General:
  - .1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.
- .2 Definitions:
  - .1 Cx as used in this section includes:
    - .1 Cx of components, equipment, systems, subsystems, and integrated systems.
    - .2 Factory inspections and FPT.
- .3 Deliverables: provide:
  - .1 Cx Specifications.
  - .2 Start-up, pre-Cx activities and documentation for systems, and equipment.
  - .3 Completed static verification forms.
  - .4 Completed start-up report forms.
  - .5 Completed FPT report forms.
  - .6 Results of FPT and Inspections.
  - .7 Description of Cx activities and documentation.

- .8 Description of Cx of integrated systems and documentation.
- .9 Tests witnessed by PWGSC Design Quality Review Team.
- .10 Tests performed by Owner/User.
- .11 Training Plans.
- .12 Cx Reports.
- .13 Prescribed activities during warranty period.
- .4 Consultant to witness and certify tests and reports of results provided to Departmental Representative.
- .5 Departmental Representative to participate.

#### **1.11 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION**

- .1 Items listed in this Cx Plan include the following:
  - .1 Pre-Start-Up inspections: by Departmental Representative prior to permission to start up and rectification of deficiencies to Departmental Representative's satisfaction.
  - .2 Departmental Representative to use approved check lists.
  - .3 Departmental Representative will monitor some of these pre-start-up inspections.
  - .4 Include completed documentation with Cx report.
  - .5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Departmental Representative and does not form part of Cx specifications.
  - .6 Departmental Representative will monitor some of these inspections and tests.
  - .7 Include completed documentation in Cx report.
- .2 Pre-Cx activities – ARCHITECTURAL AND STRUCTURAL:
  - .1 Doors, windows, related hardware:
    - .1 Door and window hardware: Check for correct functioning of hardware.
- .3 Pre-Cx activities - MECHANICAL:
  - .1 Plumbing systems:
    - .1 "Bump" each item of equipment in its "stand-alone" mode.
    - .2 Complete pre-start-up checks and complete relevant documentation.
    - .3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.
  - .2 HVAC equipment and systems:
    - .1 "Bump" each item of equipment in its "stand-alone" mode.
    - .2 At this time, complete pre-start-up checks and complete relevant documentation.

- .3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.
- .4 Perform OPT on systems. OPT reports to be approved by Departmental Representative.
- .3 EMCS:
  - .1 EMCS trending to be available as supporting documentation for functional performance testing.
  - .2 Perform point-by-point testing in parallel with start-up.
  - .3 Carry out point-by-point verification.
  - .4 Demonstrate performance of systems, to be witnessed by Departmental Representative prior to start of 10 day Final Acceptance Test period.
  - .5 Perform final Cx and operational tests during demonstration period and 30 day test period.
  - .6 Only additional testing after foregoing have been successfully completed to be "Off-Season Tests".
- .4 Pre-Cx activities - LIFE SAFETY SYSTEMS
  - .1 Include equipment and systems identified above.
  - .2 Reports of test results to be witnessed and certified by Departmental Representative before verification.
- .5 Pre-Cx activities - ELECTRICAL:
  - .1 Low voltage distribution systems under 750 V:
    - .1 Requires independent testing agency to perform pre-energisation and post-energisation tests.
  - .2 Emergency power generation systems.
    - .1 Transfer switches: Test by simulating loss of power. Verify availability of power at equipment requiring same.
    - .2 Uninterruptible power systems: Test under full and partial load conditions.
  - .3 Lighting systems:
    - .1 Emergency lighting systems:
      - .1 Tests to include verification of lighting levels and coverage, initially by disrupting normal power.
  - .4 Fire alarm systems: Test after other safety and security systems are completed. Testing to include a complete verification in accordance with ULC requirements. Consultant has witnessed and certified report, demonstrate devices and zones to Departmental Representative.
  - .5 Low voltage systems: include:
    - .1 Low voltage lighting control systems.
  - .6 Security, surveillance and intrusion alarm systems: Include verification by Departmental Representative.
- .6 Start up components, equipment, and systems.

- .7 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up equipment and systems under Contractor's direction.
- .8 Departmental Representative to monitor some of these start-up activities.
  - .1 Rectify start-up deficiencies to satisfaction of Departmental Representative.
- .9 Functional Performance Testing:
  - .1 Approved Cx Agent to perform.
    - .1 Repeat when necessary until results are acceptable to Departmental Representative.
  - .2 Use procedures modified generic procedures to suit project requirements.
  - .3 Consultant to witness and certify reported results using approved static verification, start-up, and FPT forms.
  - .4 Consultant to approve completed FPT reports and provide to Departmental Representative.
  - .5 Departmental Representative reserves right to verify up to 30% of reported results at random.
  - .6 Failure of randomly selected item shall result in rejection of FPT report or report of system start-up and testing.

#### **1.12 CX ACTIVITIES AND RELATED DOCUMENTATION**

- .1 Perform Cx by specified Cx agency using procedures developed by Consultant and approved by Departmental Representative.
- .2 Departmental Representative to monitor Cx activities.
- .3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved FPT forms.
- .4 Consultant to witness and certify reported results of Cx activities and forward to Departmental Representative.
- .5 Departmental Representative reserves right to verify a percentage of reported results at no cost to contract.

#### **1.13 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION**

- .1 Cx to be performed by specified Cx specialist, using procedures developed by Consultant and approved by Departmental Representative.
- .2 Tests to be witnessed by Consultant and documented on approved report forms.
- .3 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be certified by Consultant and submitted to Departmental Representative for review.
- .4 Departmental Representative reserves right to verify percentage of reported results.
- .5 Integrated systems to include:
  - .1 HVAC and associated systems forming part of integrated HVAC systems.
  - .2 Smoke control systems.

- .3 Indoor air quality.
- .4 Environmental space conditions.
- .5 Fire alarm systems.
- .6 Fire pumps and controllers.
- .7 Emergency power generator.
- .8 Transfer switch and controllers.
- .9 Emergency lighting systems.
- .6 Identification:
  - .1 In later stages of Cx, before hand-over and acceptance Departmental Representative, Contractor, Project Manager, Property Manager and Cx Manager to co-operate to complete inventory data sheets and provide assistance to PWGSC in full implementation of MMS identification system of components, equipment, sub-systems, systems.

#### **1.14 STATIC VERIFICATION CHECK LISTS**

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms.

#### **1.15 START-UP REPORT FORMS**

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms.

#### **1.16 FUNCTIONAL PERFORMANCE TESTING FORMS**

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms.

#### **1.17 DELIVERABLES RELATING TO ADMINISTRATION OF CX**

- .1 General:
  - .1 Because of risk assessment, complete Cx of occupancy, weather and seasonal-sensitive equipment and systems in these areas before building is occupied.

#### **1.18 CX SCHEDULES**

- .1 Prepare detailed critical path Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:
  - .1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:
    - .1 Design criteria, design intents.
    - .2 Pre-OPT review: 28 days after contract award, and before construction starts.
    - .3 Cx agents' credentials: 60 days before start of Cx.
    - .4 Cx procedures: 3 months after award of contract.
    - .5 Cx Report format: 3 months after contract award.

- .6 Discussion of heating/cooling loads for Cx: 3 months before start-up.
- .7 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.
- .8 Notification of intention to start OPT: 21 days before start of OPT.
- .9 OPT: After successful start-up, correction of deficiencies and verification of normal and safe operation.
- .10 Notification of intention to start Cx: 14 days before start of Cx.
- .11 Notification of intention to start Cx of integrated systems: After Cx of related systems is completed 14 days before start of integrated system Cx.
- .12 Identification of deferred Cx.
- .13 Implementation of training plans.
- .14 CX of smoke management/control systems: After Cx of related systems is completed and 7 days before proposed date of Cx these systems.
- .15 Cx stair shaft pressurization systems: Before issuance of occupancy certificate.
- .16 Cx reports: Immediately upon successful completion of Cx.
- .17 Emergency evacuation exercises: After 80% occupancy.
- .2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Property Manager.
- .3 6 months in Cx schedule for verification of performance in all seasons and wear conditions.
- .2 After approval, incorporate Cx Schedule into Construction Schedule.
- .3 Consultant, Contractor, Contractor's Cx agent, and Departmental Representative will monitor progress of Cx against this schedule.

#### **1.19 CX REPORTS**

- .1 Submit reports of tests, witnessed and certified by Consultant, to Departmental Representative who will verify reported results.
- .2 Include completed and certified FPT reports in properly formatted Cx Reports.
- .3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.

#### **1.20 ACTIVITIES DURING WARRANTY PERIOD**

- .1 Cx activities must be completed before issuance of Interim Certificate. It is anticipated that certain Cx activities may be necessary during Warranty Period, including:
  - .1 Fine tuning of HVAC systems.
  - .2 Adjustment of ventilation rates to promote good indoor air quality and reduce deleterious effects of VOCs generated by off-gassing from construction materials and furnishings.



.3 Full-scale emergency evacuation exercises.

**1.21 TRAINING PLANS**

.1 Refer to Section 01 91 41 - Commissioning (Cx) - Training.

**1.22 FINAL SETTINGS**

.1 Upon completion of Cx to satisfaction of Departmental Representative, lock control devices in their final positions, indelibly mark settings, and include in Cx Reports.

**Part 2 Products**

Not Used.

**Part 3 Execution**

Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

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

**1.2                STATIC VERIFICATION/START-UP CHECK LISTS**

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

**1.3                FUNCTIONAL PERFORMANCE TESTING FORMS**

- .1    FPT forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.
- .2    FPT report forms include those developed by Contractor records measured data and readings taken during functional testing and FPT procedures.
- .3    Prior to FPT of integrated system, complete FPT forms of related systems and obtain Departmental Representative's approval.

#### **1.4 SAMPLES OF COMMISSIONING FORMS**

- .1 Consultant will develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data.
- .2 Revise items on Commissioning forms to suit project requirements.
- .3 Samples of Commissioning forms and a complete index of produced to date will be attached to this section.

#### **1.5 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS**

- .1 When additional forms are required, but are not available from Consultant, develop appropriate verification forms and submit to Departmental Representative for approval prior to use.
  - .1 Additional commissioning forms to be in same format as provided by Consultant.

#### **1.6 COMMISSIONING FORMS**

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
  - .1 Consultant provides Contractor project-specific Commissioning forms with Specification data included.
  - .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
  - .3 Confirm operation to design criteria and intent.
  - .4 Identify variances between design and operation, and reasons for variances.
  - .5 Verify operation in specified normal and emergency modes and under specified load conditions.
  - .6 Record analytical and substantiating data.
  - .7 Verify reported results.
  - .8 Form to bear signatures of recording technician, and reviewed and signed off by Departmental Representative.
  - .9 Submit immediately after tests are performed.
  - .10 Report results in true measured SI unit values.
  - .11 Provide Departmental Representative with originals of completed forms.
  - .12 Maintain copy on site during start-up, testing, and commissioning period.
  - .13 Forms to be both hard copy and electronic format with typed written results on SOM, in accordance with Section 01 91 51 – System Operation Manual.

#### **1.7 LANGUAGE**

- .1 To suit the language profile of the awarded contract.

**Part 2          Products**

Not Used.

**Part 3          Execution**

Not Used.

**END OF SECTION**

# ACCESS CONTROL SYSTEM

Refer to Section 28 13 23

REVISION #: \_\_\_\_\_

NAME: _____	PROJECT No.: _____
COMPANY: _____	FILE NUMBER: _____
ADDRESS: _____	DRAWING No.: _____
_____	BUILDING No.: _____
CLIENT: _____	TAG No.: _____
ADDRESS: _____	DATE (DDMMYYYY): _____

COMPONENTS	SPECIFIED	SHOP DRAWINGS	INSTALLED
Card Reader			
Request to Exir Motion Sensor			
Door Contact			
Power Supply			
Other Accessories			

FIELD REVIEW AND COMPLIANCE ACTIVITY	STATUS			COMMENTS
	YES	NO	N/A	
1. Equipment is installed as per the approved shop drawings.				
2. Access Control Unit is installed in location as designed.				
3. Record Date, revision, and version of firmware.				
4. Cabinet, Plug-in units and modules are securely fastened.				
5. Cabinets equiped with continious tamper detection.				
6. Cabinets are housed in locable cabinets.				
7. Controller Unit has a stand alone monitoring and scramble pad control.				
8. Stores a minimum of 3000 event transactions for later uploading to central monitoring station				
9. Access Control Unit is powered by a dedicated Electrical circuit and is clearly identified for Access Control.				
10. Tamper alarm is generated when controller cabinet is opened.				
11. Tamper/restored.				
12. Communications/fail with Central Monitoring Station.				
13. Communications/ restored with Central monitoring Station.				
14. Power fail alarm generated.				
15. Control Unit on Battery, Low Battery alarm.				
16. Minimum 24-battery back-up record number of hours.				
17. Power restore alarm.				
18. General Housekeeping Complete.				

## NONCONFORMANCE DESCRIPTION:

POSITION/TITLE	NAME	SIGNATURE	DATE
Witnessed By:			
DCC Site Engineer:			
Design Authority:			

# FANS

## Static Verification

REVISION #: \_\_\_\_\_

NAME: \_\_\_\_\_

COMPANY: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

CUSTOMER: \_\_\_\_\_

PROJECT: \_\_\_\_\_

FILE NUMBER: \_\_\_\_\_

DATE: \_\_\_\_\_

### NAMEPLATE

MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

EXHAUST FAN	SPECIFIED	SHOP DRAWINGS	INSTALLED
MANUFACTURER			
TYPE/ SIZE			
MODEL NO.			
MOTOR CONTROL CENTRE NO.			
MOTOR HP			
VOLTAGE / PHASE / FREQUENCY			
STATIC PRESSURE AIR (PA)			
FAN RPM			
AIR VOLUME (L/S)			
VIBRATION ISOLATOR TYPE			

EXHAUST FAN	STATUS	COMMENTS
INSTALLED AS PER DRAWINGS & SPECIFICATIONS		
INSTALLED AS PER MANUFACTURER'S REQUIREMENTS		
FAN BEARINGS LUBRICATED		
GREASE EXTENSION LEADS REQUIRED		
FAN ROTATION CORRECT		
FAN CASING CLEANED		
BELT GUARDS INSTALLED		
ALIGNMENT REPORT ATTACHED		
INLET & OUTLET GUARDS INSTALLED		
DUCT GEOMETRY CORRECT		
FLEXIBLE CONNECTORS CORRECT		
VIBRATION ISOLATORS CORRECT		
STARTER & DISCONNECT COMPLETE		
DISCONNECT LOCATION CORRECT		
BELT TENSION		
FAN WHEEL CLEARANCE		
FAN INTERLOCKS CORRECT		
VARIABLE SPEED DRIVE/VOLUME CONTROLS		

# FANS

## Static Verification

REVISION #: \_\_\_\_\_

NAME: \_\_\_\_\_

COMPANY: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

CUSTOMER: \_\_\_\_\_

PROJECT: \_\_\_\_\_

FILE NUMBER: \_\_\_\_\_

DATE: \_\_\_\_\_

### NAMEPLATE

MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

AIR DISTRIBUTION SYSTEM	STATUS	COMMENTS
QUALITY OF DUCT CONSTRUCTION		
SUITABILITY OF DUCT FITTINGS		
DUCTWORK INSULATION		
WALL PENETRATIONS SEALED		
ACCESS FOR INSPECTION & SERVICING		
DUCT MOUNTED ACCESS DOORS CLOSED		
FIRE DAMPERS OPEN		

START-UP	STATUS	COMMENTS
ALL SYSTEM COMPONENTS STARTED AS DETAILED ON EQUIPMENT START-UP SHEETS.		
DUCTWORK PRESSURE TESTED		
NOISE & VIBRATION		
AIR BALANCING COMPLETE		
AIR BALANCE REPORT ATTACHED		

MOTORIZED DAMPER	SPECIFIED	SHOP DRAWINGS	INSTALLED
MANUFACTURER			
TYPE OR MODEL NO.			
SUPPLY DAMPER SIZE			
RETURN DAMPER SIZE			

MOTORIZED DAMPER	STATUS		
	NO. 1	NO. 2	NO. 3
DAMPERS			
DAMPER LOCATION			
AIR LEAKAGE AT SHUTOFF			
NO CRACKS AROUND DAMPER FRAME			
BLADES CLOSE FULLY, SEAL TIGHTLY			
MOTORIZED DAMPER STROKES FULLY OPEN TO FULLY CLOSED			
DAMPER ACCESSIBLE & IDENTIFIED			

### NAMEPLATE

# FANS

## Static Verification

REVISION #: \_\_\_\_\_

NAME: \_\_\_\_\_

COMPANY: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

CUSTOMER: \_\_\_\_\_

PROJECT: \_\_\_\_\_

FILE NUMBER: \_\_\_\_\_

DATE: \_\_\_\_\_

MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

MOTORIZED DAMPER	STATUS		
	NO. 1	NO. 2	NO. 3
LINKAGE CONNECTIONS INSTALLED			
FREE MOVEMENT & STROKE			
ACCESS TO DAMPER			
ACTUATOR NOT IN AIR STREAM			
NORMAL POSITIONS AS SPECIFIED			
DAMPER CONTROL SEQUENCES			
MIXING DAMPERS STROKE IN UNISON			
LINKAGE CONNECTIONS INSTALLED			
FREE MOVEMENT & STROKE			
ACCESS TO DAMPER			
ACTUATOR NOT IN AIR STREAM			
NORMAL POSITIONS AS SPECIFIED			
DAMPER CONTROL SEQUENCES			
MIXING DAMPERS STROKE IN UNISON			

### GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE



# FANS

## Start-Up

REVISION #: \_\_\_\_\_

NAME: \_\_\_\_\_

COMPANY: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

CUSTOMER: \_\_\_\_\_

PROJECT: \_\_\_\_\_

FILE NUMBER: \_\_\_\_\_

DATE: \_\_\_\_\_

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### GENERAL COMMENTS:

POSITION/TITLE	SIGNATURE	DATE

**FANS**  
**Functional Performance Testing**

REVISION #: \_\_\_\_\_

NAME: \_\_\_\_\_  
COMPANY: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_  
\_\_\_\_\_

CUSTOMER: \_\_\_\_\_  
PROJECT: \_\_\_\_\_  
FILE NUMBER: \_\_\_\_\_  
DATE: \_\_\_\_\_

**SHEET INTENTIONALLY LEFT BLANK FOR INDIVIDUAL TO POPULATE AS NEEDED**

**GENERAL COMMENTS:**

POSITION/TITLE	SIGNATURE	DATE

# INSULATED MOLDED CASE CIRCUIT BREAKERS

## Functional Performance Testing

REVISION #: \_\_\_\_\_

NAME: \_\_\_\_\_  
 COMPANY: \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

CUSTOMER: \_\_\_\_\_  
 PROJECT: \_\_\_\_\_  
 FILE NUMBER: \_\_\_\_\_  
 DATE: \_\_\_\_\_

NAMEPLATE DATA			
MANUFACTURER		SERIAL NO.	

EQUIP. TEMPERATURE	°C	Indicates Temperature Corrected Reading to 20°C
--------------------	----	---

CONTACT RESISTANCE	RESISTANCE TCF:		
	PHASE A	PHASE B	PHASE C
INITIAL (MICRO-OHMS)			
INITIAL (MICRO-OHMS)			
CLEANED (MICRO-OHMS)			
CLEANED (MICRO-OHMS)			

ELECTRICAL OPERATIONS			
CLOSE		OK	N/A
TRIP		OK	N/A
TRIP-FREE		OK	N/A
ANTIPUMP		OK	N/A

MINIMUM COIL PICKUPS	
CLOSE COIL	V
TRIP COIL	V

BOLTED CONNECTION RESISTANCE	FROM	MICRO-OHMS	MILLI-OHMS	RESISTANCE TCF:				
				PHASE A	PHASE B	PHASE C	NEUTRAL	GROUND

INSULATION TESTS	MEG-OHMS		MICRO-AMPS	INSULATION TCF:			
	KV	TIME (min)		PHASE A	PHASE B	PHASE C	NEUTRAL
PHASE-TO-PHASE							
PHASE-TO-GROUND							
LINE-TO-LOAD							

BREAKER NAMEPLATE
-------------------

# INSULATED MOLDED CASE CIRCUIT BREAKERS

## Functional Performance Testing

REVISION #: \_\_\_\_\_

NAME: \_\_\_\_\_

COMPANY: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

CUSTOMER: \_\_\_\_\_

PROJECT: \_\_\_\_\_

FILE NUMBER: \_\_\_\_\_

DATE: \_\_\_\_\_

MANUFACTURER		SERIAL NO.	
TYPE		CATALOG NO.	
FRAME SIZE (F)		MOUNTING	B.I. D.O.

TRIP UNIT NAMEPLATE									
MANUFACTURER							CT RATIO		
TYPE							RATING PLUG(R)		
THERMAL MEMORY				ON			OFF		SENSOR TAP
	ZONE INTLK			TARGETS					

SETTINGS AS FOUND				LONG TIME PU		DELAY	
RATING PLUG(R)		SHORT TIME PU				DELAY	I <sup>2</sup> T IN OUT N/A
SENSOR TAP		INST. PU	ON	OFF			
GRD. FLT.	3W	4W	GRD. FLT. PU	ON	OFF	DELAY	I <sup>2</sup> T IN OUT N/A

SETTINGS AS LEFT				LONG TIME PU		DELAY	
RATING PLUG(R)		SHORT TIME PU				DELAY	I <sup>2</sup> T IN OUT N/A
SENSOR TAP		INST. PU	ON	OFF			
GRD. FLT.	3W	4W	GRD. FLT. PU	ON	OFF	DELAY	I <sup>2</sup> T IN OUT N/A

PRIMARY INJECTION	SECONDARY INJECTION	MFG. TIME CURRENT CURVE NO.
-------------------	---------------------	-----------------------------

PICKUP TESTS	MFG STANDARD		PHASE A		PHASE B		PHASE C	
	MIN	MAX	FOUND	LEFT	FOUND	LEFT	FOUND	LEFT
INSTANTANEOUS								
LONG TIME								
SHORT TIME								
GROUND FAULT								

TIME DELAY TESTS			PHASE A				PHASE B				PHASE C			
	MFG STANDARD		FOUND		LEFT		FOUND		LEFT		FOUND		LEFT	
	MIN	MAX	AMPS	DELAY	AMPS	DELAY	AMPS	DELAY	AMPS	DELAY	AMPS	DELAY	AMPS	DELAY
INSTANTANEOUS														
LONG TIME														
SHORT TIME														
GROUND FAULT														

GENERAL COMMENTS:

**INSULATED MOLDED CASE CIRCUIT BREAKERS**  
**Functional Performance Testing**

REVISION #: \_\_\_\_\_

NAME: \_\_\_\_\_  
COMPANY: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_  
\_\_\_\_\_

CUSTOMER: \_\_\_\_\_  
PROJECT: \_\_\_\_\_  
FILE NUMBER: \_\_\_\_\_  
DATE: \_\_\_\_\_

POSITION/TITLE	SIGNATURE	DATE

# INTRUSION ALARM SYSTEM

Refer to Section 28 16 19

REVISION #: \_\_\_\_\_

NAME: _____	PROJECT No.: _____
COMPANY: _____	FILE NUMBER: _____
ADDRESS: _____	DRAWING No.: _____
_____	BUILDING No.: _____
CLIENT: _____	TAG No.: _____
ADDRESS: _____	DATE (DDMMYYYY): _____

COMPONENTS	SPECIFIED	SHOP DRAWINGS	INSTALLED
Card Reader			
Request to Exir Motion Sensor			
Door Contact			
Power Supply			
Other Accessories			

FIELD REVIEW AND COMPLIANCE ACTIVITY	STATUS			COMMENTS
	YES	NO	N/A	
1. Equipment is installed as per the approved shop drawings.				
2. Control Unit is installed in location as designed.				
3. Record Date, revision, and version of firmware.				
4. Cabinet, Plug-in units and modules are securely fastened.				
5. Cabinets equiped with continious tamper detection.				
6. Cabinets are housed in locable cabinets.				
7. Controller Unit has a stand alone alarm monitoring and keypad control.				
8. Stores a minimum of 500 event transactions for later uploading to central monitoring station				
9. Control Unit is powered by a dedicated Electrical circuit and is clearly identified for Access Control.				
10. Tamper alarm is generated when controller cabinet is opened.				
11. Tamper/restored.				
12. Communications/fail with keypad/Central Monitoring Station.				
13. Communications/ restored with keypad/Central Monitoring Station.				
14. Power fail alarm generated.				
15. Control Unit on Battery, Low Battery alarm.				
16. Minimum 24-battery back-up record number of hours.				
17. Record the number of Keypads connected to the controller unit.				
18. Power restore alarm.				
19. General Housekeeping Complete.				

## NONCONFORMANCE DESCRIPTION:

POSITION/TITLE	NAME	SIGNATURE	DATE
Witnessed By:			
DCC Site Engineer:			
Design Authority:			

# SOUND MASKING SYSTEM

Refer to Section 27 08 00

REVISION #: \_\_\_\_\_

NAME:	_____	PROJECT No.:	_____
COMPANY:	_____	FILE NUMBER:	_____
ADDRESS:	_____	DRAWING No.:	_____
	_____	BUILDING No.:	_____
CLIENT:	_____	TAG No.:	_____
ADDRESS:	_____	DATE (DDMMYYYY):	_____

COMPONENTS	SPECIFIED	SHOP DRAWINGS	INSTALLED
Amplifier			
Mixer			
Speakers			
Input/Output Modules			
Other Accessories			

FIELD REVIEW AND COMPLIANCE ACTIVITY	STATUS			COMMENTS
	YES	NO	N/A	
1. Equipment is installed as per the approved shop drawings.				
2. Speakers installed as per the drawings and revisions.				
3. Record Date, revision, and version of firmware.				
4. Functional test of all zones.				
5. Maximum Output of Amplifier.				
6. Impedance of each speaker line.				
7. Total wattage on each zone.				
8. Testing of each speaker line for shorts to ground.				
9. Sound masking adjusted to customer's acceptable comfort level				

## NONCONFORMANCE DESCRIPTION:

POSITION/TITLE	NAME	SIGNATURE	DATE
Witnessed By:			
DCC Site Engineer:			
Design Authority:			

## Static Verification

NAME: \_\_\_\_\_  
COMPANY: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_

CUSTOMER: \_\_\_\_\_  
PROJECT: \_\_\_\_\_  
FILE NUMBER: \_\_\_\_\_  
DATE: \_\_\_\_\_

MANUFACTURER		EQUIPMENT NO.	
SERVICE		LOCATION	

MANUFACTURER, MODEL & TYPE	VAV-1	VAV-2	VAV-3	VAV-4	VAV-5	VAV-6
LOCATION						
SIZE						
FLOW (L/S) (DESIGN/ACTUAL)						
INLET DUCT LENGTH (MIN. 4 X DUCT I)						
SILENCER/ACOUSTIC DUCT INSTALLED						
VAV BOX UNDAMAGED						
VAV BOX SUPPORTED CORRECTLY						
IDENTIFICATION TAGS VISIBLE						
CONTROLS ACCESSIBLE						

GENERAL NOTES	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5	UNIT 6
PIPING CORRECT						
PIPING IDENTIFIED						
PIPING INSULATED						
DRAIN INSTALLED						
AIR VENT INSTALLED						
SHUT OFF VALVE INSTALLED						
ACCESS DOORS INSTALLED						

CONTROL VALVE OPERATION						
CONTROLS VERIFIED						
ENTERING AIR TEMPERATURE AT MAXIMUM AIR FLOW						
EXITING AIR TEMPERATURE AT MAXIMUM AIR FLOW						



**VAV BOX**  
**Static Verification**

REVISION #: \_\_\_\_\_

NAME: \_\_\_\_\_  
COMPANY: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_  
\_\_\_\_\_

CUSTOMER: \_\_\_\_\_  
PROJECT: \_\_\_\_\_  
FILE NUMBER: \_\_\_\_\_  
DATE: \_\_\_\_\_

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POSITION/TITLE	SIGNATURE	DATE

# VAV BOX

## Start-Up

REVISION #: \_\_\_\_\_

NAME: \_\_\_\_\_

COMPANY: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

CUSTOMER: \_\_\_\_\_

PROJECT: \_\_\_\_\_

FILE NUMBER: \_\_\_\_\_

DATE: \_\_\_\_\_

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**GENERAL COMMENTS:**

POSITION/TITLE	SIGNATURE	DATE

**VAV BOX**  
**Functional Performance Testing**

REVISION #: \_\_\_\_\_

NAME: \_\_\_\_\_  
COMPANY: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_  
\_\_\_\_\_

CUSTOMER: \_\_\_\_\_  
PROJECT: \_\_\_\_\_  
FILE NUMBER: \_\_\_\_\_  
DATE: \_\_\_\_\_

**SHEET INTENTIONALLY LEFT BLANK FOR INDIVIDUAL TO POPULATE AS NEEDED**

**GENERAL COMMENTS:**

POSITION/TITLE	SIGNATURE	DATE

# VIDEO SURVEILLANCE SYSTEM

Refer to Section 28 23 29

REVISION #: \_\_\_\_\_

NAME:	_____	PROJECT No.:	_____
COMPANY:	_____	FILE NUMBER:	_____
ADDRESS:	_____	DRAWING No.:	_____
	_____	BUILDING No.:	_____
CLIENT:	_____	TAG No.:	_____
ADDRESS:	_____	DATE (DDMMYYYY):	_____

COMPONENTS	SPECIFIED	SHOP DRAWINGS	INSTALLED
Network Video recorder (NVR)			
Software and License			
Video Surveillance Camera			
Power Supply			
Other Accessories			

FIELD REVIEW AND COMPLIANCE ACTIVITY	STATUS			COMMENTS
	YES	NO	N/A	
1. Equipment is installed as per the approved shop drawings.				
2. Cameras are installed in locations required by design.				
3. Fixed cameras focal length is adjusted and adequately placed.				
4. Outdoor cameras heaters and wipers are working.				
5. Power supplies are installed and working.				
6. List provided with all cameras, model numbers, serial numbers and warranty information.				
7. Video Matrix configured and meets design intent.				
8. NVR configured and meets design intent.				
9. General Housekeeping Complete.				

## NONCONFORMANCE DESCRIPTION:

POSITION/TITLE	NAME	SIGNATURE	DATE
Witnessed By:			
DCC Site Engineer:			
Design Authority:			

**Part 1        General**

**1.1        TRAINEES**

- .1        Trainees: Personnel selected for operating and maintaining facility; includes Property Manager, building operators, maintenance staff, security staff, and technical specialists as required.
- .2        Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

**1.2        INSTRUCTORS**

- .1        Consultant will provide:
  - .1        Descriptions of systems.
  - .2        Instruction on design philosophy, design criteria, and design intent.
- .2        Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:
  - .1        Start-up, operation, shut-down of equipment, components and systems.
  - .2        Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.
  - .3        Instructions on servicing, maintenance, and adjustment of systems, equipment, and components.
- .3        Contractor and equipment manufacturer to provide instruction on:
  - .1        Start-up, operation, maintenance, and shut-down of equipment they have certified installation, started up and carried out FPT.

**1.3        TRAINING OBJECTIVES**

- .1        Training to be detailed and duration to ensure:
  - .1        Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
  - .2        Effective on-going inspection, measurements of system performance.
  - .3        Proper preventive maintenance, diagnosis, and trouble-shooting.
  - .4        Ability to update documentation.
  - .5        Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

**1.4        TRAINING MATERIALS**

- .1        Instructors to be responsible for content and quality.
- .2        Training materials to include:
  - .1        "As-Built" Contract Documents.
  - .2        Operating Manual.
  - .3        Maintenance Manual.

- .4 Management Manual.
- .5 OPT and FPT Reports.
- .3 Project Manager, Commissioning Manager, and Property Manager will review training manuals.
- .4 Training materials to be in a format that permits future training procedures to same degree of detail.
- .5 Supplement training materials:
  - .1 Transparencies for overhead projectors.
  - .2 Multimedia presentations.
  - .3 Manufacturer's training videos.
  - .4 Equipment models.

## **1.5 SCHEDULING**

- .1 Include in Commissioning Schedule time for training.
- .2 Deliver training during regular working hours, training sessions to be 3 hours in length.
- .3 Training to be completed prior to acceptance of facility.

## **1.6 RESPONSIBILITIES**

- .1 Be responsible for:
  - .1 Implementation of training activities,
  - .2 Coordination among instructors,
  - .3 Quality of training, training materials,
- .2 Departmental Representative will evaluate training and materials.
- .3 Upon completion of training, provide written report, signed by Instructors, witnessed by Departmental Representative.

## **1.7 TRAINING CONTENT**

- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
- .2 Content includes:
  - .1 Review of facility and occupancy profile.
  - .2 Functional requirements.
  - .3 System philosophy, limitations of systems, and emergency procedures.
  - .4 Review of system layout, equipment, components and controls.
  - .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
  - .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.

- .7 Maintenance and servicing.
- .8 Trouble-shooting diagnosis.
- .9 Inter-Action among systems during integrated operation.
- .10 Review of O & M documentation.
- .3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

**Part 2        Products**  
Not Used.

**Part 3        Execution**  
Not Used.

**END OF SECTION**

**Part 1 General****1.1 SUMMARY**

- .1 Acronyms:
  - .1 Cx - Commissioning.
  - .2 FPT - Functional Performance Testing.
  - .3 HVAC - Heating, Ventilation and Air Conditioning.
  - .4 OPT – Optimization.
  - .5 SOM – Systems Operation Manual.
  - .6 TAB - Testing, Adjusting, and Balancing.
  - .7 WHMIS - Workplace Hazardous Materials Information System.

**1.2 GENERAL REQUIREMENTS**

- .1 Standard letter size paper 216 mm x 279 mm.
- .2 Methodology used to facilitate updating.
- .3 Drawings, diagrams and schematics to be professionally developed.
- .4 Electronic copy of data to be in a format accepted and approved by Departmental Representative and Consultant.

**1.3 APPROVALS**

- .1 Prior to commencement, co-ordinate requirements for preparation, submission, and approval with Departmental Representative.

**1.4 GENERAL INFORMATION**

- .1 Provide Departmental Representative and Consultant the following for insertion into appropriate Part and Section of SOM:
  - .1 Complete list of names, addresses, telephone and fax numbers of contractor, sub-contractors that participated in delivery of project - as indicated in Section 1.2 of SOM.
  - .2 Summary of architectural, structural, fire protection, mechanical, and electrical systems installed and commissioned - as indicated in Section 1.4 of SOM.
    - .1 Include sequence of operation as finalized after commissioning is complete as indicated in Section 2.0 of SOM.
  - .3 Description of building operation under conditions of heightened security and emergencies as indicated in Section 2.0 of SOM.
  - .4 System, equipment, and components Maintenance Management System (MMS) identification - Section 2.1 of SOM.
  - .5 Information on operation and maintenance of architectural systems and equipment installed and commissioned - Section 2.0 of SOM.



- .6 Information on operation and maintenance of fire protection and life safety systems and equipment installed and commissioned - Section 2.0 of SOM.
- .7 Information on operation and maintenance of mechanical systems and equipment installed and commissioned - Section 2.0 of SOM.
- .8 Operating and maintenance manual - Section 3.2 of SOM.
- .9 Final commissioning plan as actually implemented.
- .10 Completed commissioning checklists.
- .11 Commissioning test procedures employed.
- .12 Completed Static Verification (SV) and Functional Performance Testing (FPT) report forms, reviewed by Departmental Representative.
- .13 Commissioning reports.

## **1.5 CONTENTS OF OPERATING AND MAINTENANCE MANUAL**

- .1 Departmental Representative to review and approve format and organization within 6 weeks of award of contract.
- .2 Include original manufacturers' brochures and written information on products and equipment installed on this project.
- .3 Record and organize for easy access and retrieval of information contained in SOM.
- .4 Include completed static verification report forms, data, and information from other sources as required.
- .5 Inventory directory relating to information on installed systems, equipment and components.
- .6 Approved project shop-drawings, product, and maintenance data.
- .7 Manufacturers' data and recommendations relating manufacturing process, installation, commissioning, start-up, O & M, shutdown, and training materials.
- .8 Inventory and location of spare parts, special tools, and maintenance materials.
- .9 Warranty information.
- .10 Inspection certificates with expiration dates, that require on-going re-certification inspections.
- .11 Maintenance program supporting information including:
  - .1 Recommended maintenance procedures and schedule.
  - .2 Information to removal and replacement of equipment including, required equipment, points of lift, and means of entry and egress.

## **1.6 LIFE SAFETY COMPLIANCE (LSC) MANUAL**

- .1 Samples of LSC Manual will be available from Departmental Representative.
- .2 Content of Manual:

- .1 All possible Emergency situations modes including: Presence of fire and smoke, power failure, lose of water or pressure, chemical spills, and refrigerant release.
- .2 Failure of elevators.
- .3 HVAC emergencies and fuel supply failures.
- .4 Intrusion and security breach.
- .5 Emergency provisions for natural disasters, bomb threats, and other disruptive situations.
- .6 Dedicated emergency generators.
- .7 Emergency control procedures for fire, power, and major equipment failure.
- .8 Emergency contacts and numbers.
- .9 Manual to be readily available and comprehensible to non-technical readers.

## **1.7 SUPPORTING DOCUMENTATION FOR INSERTION INTO SUPPORTING APPENDICES**

- .1 Provide Departmental Representative with supporting documentation relating to installed equipment and system, including:
  - .1 General:
    - .1 Finalized commissioning plan.
    - .2 WHMIS information manual.
    - .3 Approved record drawings and specifications.
    - .4 Procedures used during commissioning.
    - .5 Cross-reference to specification sections.
  - .2 Architectural and structural:
    - .1 Inspection certificates, construction permits.
    - .2 FPT reports.
  - .3 Fire prevention, suppression, and protection:
    - .1 Test reports.
    - .2 Smoke test reports.
    - .3 FPT reports.
  - .4 Mechanical:
    - .1 Installation permits, inspection certificates.
    - .2 Piping pressure test certificates.
    - .3 Ducting leakage test reports.
    - .4 OPT and FPT reports.
    - .5 Charts of valves and steam traps.
    - .6 Copies of posted instructions.
  - .5 Electrical:
    - .1 Installation permits, inspection certificates.
    - .2 OPT and FPT reports.

- .3 Electrical work log book.
    - .4 Charts and schedules.
    - .5 Locations of cables and components.
    - .6 Copies of posted instructions.
  - .2 Assist Departmental Representative with preparation of SOM.
- 1.8 LANGUAGE**
  - .1 English will be used for the Manual.
- 1.9 IDENTIFICATION OF FACILITY**
  - .1 When submitting information to Departmental Representative for incorporation into SOM, use following for identification of documentation:
    - .1 Veterans Affairs Canada Saskatoon Fit-Up.
- 1.10 USE OF CURRENT TECHNOLOGY**
  - .1 Use current technology for production of documentation. Emphasis on ease of accessibility at all times, maintain in up-to-date state, compatibility with user's requirements.
  - .2 Obtain Departmental Representative's approval before starting Work.
- Part 2 Products**
  - .1 Not used.
- Part 3 Execution**
  - .1 Not used.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

**1.2 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit 20 Days prior to start of demolition and removals Work.
- .3 Where required, submissions to be signed and sealed by a Professional Engineer licensed in the Province of Saskatchewan.
- .4 Shop Drawings:
  - .1 Drawings, diagrams, or details indicating sequence of disassembly Work and supporting structure.
  - .2 Plan showing impacts, interruptions, and delays to building operations.

**1.3 SITE CONDITIONS**

- .1 Perform operations, machine and equipment movements, deliveries and removals at time or times that will permit uninterrupted operations in and around structures, including parking, deliveries, and Site access and egress.
- .2 Take over structures to be demolished based on condition on date that Bids close.

**Part 2 Execution**

**2.1 GENERAL**

- .1 Products requiring demolition become Contractor's property. Remove Products from Site daily, unless such Products are otherwise specified or indicated on Contract Drawings to be reused or handed over to owner.
- .2 Stockpiling of rubble, debris, and surplus Products on Site will not be permitted.
- .3 Clean up rubble and debris resulting from Work promptly and dispose at end of day or place in waste disposal bins. Empty bins on regular basis.

**2.2 EXAMINATION**

- .1 Examine adjacent structures and other installations prior to commencement of demolition and removals Work.

**2.3 PROTECTION**

- .1 Prevent movement of or damage to adjacent structures, services and parts of existing structure to remain. Supply and install bracing and shoring as required.

- Make good any damage caused by demolition, to acceptance of Departmental Representative.
- .2 Protect adjacent structures and property against damage that might occur from falling debris or other causes. Repair or replace damage caused from Work of this Section to acceptance of Departmental Representative.
  - .3 Do not interfere with use of adjacent structures and Work areas. Maintain free, safe passage to and from adjacent structures and Work areas.
  - .4 Take precautions to support affected structures. If safety of structure being demolished, adjacent structures or services are endangered, cease demolition operations and take necessary action to support endangered item. Immediately inform Departmental Representative. Do not resume demolition until reasons for endangering have been determined and corrected and action taken to prevent further endangering.
  - .5 If movement or settlement occurs, install additional bracing and shoring as necessary and make good any damage to acceptance of Departmental Representative.
  - .6 Prevent debris from blocking surface drainage system, mechanical and electrical systems which are required to remain in operation.
  - .7 Pay particular attention to prevention of fire and elimination of fire hazards that would endanger Work or adjacent structures and premises.
  - .8 Close off access to areas where demolition is proceeding by barricades and post warning signs.
  - .9 Where required, supply, install and maintain barricades, guards, railings, lights, warning signs, security and other safety measures, and fully protect persons and property.
  - .10 Dust/Weather Protection:
    - .1 Prior to demolition Work proceeding in existing structures, temporarily enclose Work areas, access and supply and install dustproof partitions. Design partitions to prevent dust and dirt infiltration into adjoining areas.
    - .2 Prevent dust, dirt and material caused by demolition operations from entering operational areas.
    - .3 Adjust and relocate partitions as required for various operations of Work.
    - .4 Upon completion of Work, remove and dispose of partitions from Site.

## **2.4 PREPARATION**

- .1 Disconnect and/or reroute electrical data, communication and telephone service lines entering structures to be demolished. Remove abandoned lines as indicated on Contract Drawings.
- .2 Post warning signs on electrical lines and equipment that is required to remain energized.

**2.5 DEMOLITION**

- .1 Perform demolition with extreme care. Confine effects of demolition to those parts that are to be demolished.
- .2 Perform Work and prevent inconvenience to persons outside the demolition area.
- .3 Carry out demolition in accordance with the requirements of CSA S350.
- .4 Demolish parts of structure to permit construction of addition as indicated.
- .5 Perform Work to minimize dusting.
- .6 Remove wallpaper to minimize damage to underlying substrate.
- .7 Do not sell or burn materials on Site.
- .8 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as Work progresses.
- .9 At end of day's Work, leave Work in safe condition with no part in danger of toppling or falling.
- .10 Drainage and Sewer System Protection:
  - .1 Ensure that no dust, debris, nor slurry enters drainage and sewer system on Site.
  - .2 Remove and dispose of debris and slurry promptly from Site.

**END OF SECTION**

**Part 1        General**

**1.1        REFERENCES**

- .1    ASTM International
  - .1    ASTM A123/A123M-08, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2    ASTM A653/A653M-08, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
- .2    Canadian Standards Association (CSA)
  - .1    CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
  - .2    CSA O112.9-10 (R2014), Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
  - .3    CSA O141-05 (R2014), Softwood Lumber.
  - .4    CSA O151-09 (R2014), Canadian Softwood Plywood.
- .3    National Lumber Grades Authority (NLGA)
  - .1    NLGA Standard Grading Rules for Canadian Lumber (2007 edition).

**1.2        SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1    Submit manufacturer's instructions, printed product literature and data sheets for wood products and accessories. Include product characteristics, performance criteria, physical size, finish and limitations.
- .3    Shop Drawings:
  - .1    If required, submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan.

**1.3        QUALITY ASSURANCE**

- .1    Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2    Plywood and wood based composite panels in accordance with CSA and ANSI standards.

**1.4        DELIVERY, STORAGE, AND HANDLING**

- .1    Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2    Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
  - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect wood from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 FRAMING STRUCTURAL AND PANEL MATERIALS**

- .1 Lumber: Softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
  - .1 CSA O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Furring, blocking, nailing strips, grounds, rough bucks, cants, and sleepers:
  - .1 Use S2S or S4S materials.
  - .2 Board sizes: "Standard" or better grade.
  - .3 Dimension sizes: "Standard" light framing or better grade.
  - .4 Post and timbers sizes: "Standard" or better grade.
- .3 Plywood, OSB and wood based composite panels: CSA O325.
- .4 Canadian softwood plywood (CSP): CSA O151, standard construction.

### **2.2 ACCESSORIES**

- .1 General purpose adhesive: CSA O112.9.
- .2 Nails, spikes and staples: CSA B111.
- .3 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .4 Fasteners: Hot dipped galvanized steel to ASTM A123/A123M or ASTM A653/A653M for high humidity and treated wood locations, unfinished steel elsewhere.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verify conditions of substrates are acceptable for product installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.



**3.2 FURRING AND BLOCKING**

- .1 Install furring and blocking as required to space-out and support casework, cabinets, door and window frames, wall and ceiling finishes, audio-visual equipment mounting, electrical equipment mounting boards, architectural hardware, fire extinguisher brackets, and other work as required.
- .2 Install rough bucks, nailers, and linings to rough openings as required to provide backing for frames and other work.

**3.3 CLEANING**

- .1 Progress Cleaning: Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**3.4 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)
  - .1 ANSI A208.1-09, Particleboard.
  - .2 ANSI A208.2-09, Medium Density Fiberboard (MDF) for Interior Applications.
  - .3 ANSI/BHMA A156.9-2010, Cabinet Hardware.
  - .4 ANSI/BHMA A156.11-2010, Cabinet Locks.
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
  - .1 Architectural Woodwork Standards, 2<sup>nd</sup> Edition, 2014.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 71.20-M88, Adhesive, Contact, Brushable.
- .4 Canadian Standards Association (CSA)
  - .1 CSA B111-74 (R2003), Wire Nails, Spikes and Staples.
  - .2 CSA O112.10-08 (R2013), Evaluation of Adhesives for Structural Wood Products (Limited Moisture Exposure).
  - .3 CSA O151-09 (R2014), Canadian Softwood Plywood.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .6 National Electrical Manufacturers Association (NEMA)
  - .1 ANSI/NEMA LD3-2005, High-Pressure Decorative Laminates (HPDL).
- .7 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber, 2007.

**1.2 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature, and data sheets for architectural woodwork and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate details of construction, profiles, jointing, fastening and other related details.
    - .1 Scales: profiles full size, details half full size.
  - .2 Indicate materials, thicknesses, finishes and hardware.

- .3 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.

- .4 Samples:

- .1 Submit duplicate samples of laminated plastic for colour selection.

### **1.3 QUALITY ASSURANCE**

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, OSB, and wood based composite panels to CSA and ANSI standards.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .1 Protect millwork against dampness and damage during and after delivery.
  - .2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect architectural woodwork from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Softwood lumber: Unless specified otherwise, S4S, moisture content 15% or less in accordance with following standards:
  - .1 CSA O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
  - .3 AWMAC custom grade, moisture content as specified.
- .2 Machine stress-rated lumber is acceptable for all purposes.
- .3 Canadian softwood plywood (CSP): To CSA O151, standard construction.
  - .1 Plywood resin to contain no added urea-formaldehyde.
- .4 Laminated plastic for horizontal surfaces: To NEMA LD3, Horizontal Grade Standard (HGS), 1.2 ± 0.12 mm thick; suede or matte finish.

- .5 Laminated plastic for vertical surfaces: To NEMA LD3, Vertical Grade Standard (VGS), 0.7 mm ± 0.10 mm thick, suede or matte finish.
- .6 Laminated plastic liner sheet: Grade CLS, 0.5 ± 0.10 mm thick, white colour.
- .7 Laminated plastic backing sheet: Grade BKL, minimum 0.5 mm thickness.
- .8 Nails and staples: To CSA B111.
- .9 Wood screws: Stainless steel, type and size to suit application.
- .10 Splines: Metal.
- .11 Latex sealant: In accordance with Section 07 92 00 - Joint Sealants.
- .12 Laminated plastic adhesive: Contact adhesive to CAN/CGSB 71.20.

## **2.2 HARDWARE**

- .1 General:
  - .1 All hardware to be to BHMA A156.9.
  - .2 Finish: Brushed nickel or stainless steel, unless otherwise specified.
- .2 Hinges: European style hinges.
- .3 Pulls: Contemporary bar style, surface mounted.
  - .1 Mounting: 192 mm center-to-center screw attachment.
  - .2 Handle diameter: 10 mm.
  - .3 Overall dimension: 248 mm long; 35 mm projection from mounting surface.
  - .4 Finish: Brushed stainless steel.
  - .5 Confirm proposed product with Departmental Representative.
- .4 Catches: Type I – magnetic catch.
- .5 Adjustable shelf standards and supports: Vertical slotted shelf standard, type B04102.
- .6 Drawer slides: Full extension, side-mounted drawer slides with ball bearings, zinc coated steel, 30 kg (66 lb) load capacity, soft closing.
- .7 Cabinet Locks: ANSI/BHMA A156.11, Grade 1; keyed cylinder, two keys per lock, master keyed, steel with satin finish; complete with strike.
  - .1 Body: Die cast zinc.
  - .2 Cylinder: Solid brass, pin tumbler.
  - .3 Coordinate keying with Departmental Representative.

## **2.3 MANUFACTURED UNITS**

- .1 Fabricate architectural woodwork to AWMAC Custom grade.
- .2 Casework:
  - .1 Construction type: Frameless.
  - .2 Cabinet and door interface: Flush overlay.

- .3 Core:
  - .1 Top, bottom, gables, doors, body, shelves, and valances: Particleboard, 19 mm thick.
  - .2 Backs: Particleboard, 13 mm thick.
- .4 Surfaces:
  - .1 Exposed exterior surfaces: HPDL.
  - .2 Exposed interior surfaces: HPDL matching exposed surfaces.
  - .3 Semi-exposed surfaces: Cabinet liner vertical grade laminate, white.
  - .4 Concealed: Manufacturer's choice.
- .5 Edgeband: Post-formed.
- .6 Ladder base: Canadian softwood plywood, 19 mm thick.
  - .1 Kitchenette: Mount 6 mm moisture resistant MDF to front face of ladder base.
- .3 Drawers:
  - .1 Fronts: Particle board core, 19 mm thick, with HPDL.
  - .2 Sides and Backs:
    - .1 Particle board, 16 mm, with white melamine surfaces.
  - .3 Bottoms:
    - .1 Tempered hardboard, 13 mm thick, with white melamine surfaces.
- .4 Laminated plastic countertops:
  - .1 Core material: Particleboard.
  - .2 Surface: HPDL.
  - .3 Front edges and exposed side edges: Post-formed.
- .5 Transaction counter:
  - .1 Plywood core.
  - .2 Horizontal surface: HPDL.
  - .3 Edgeband: Self-edge.
  - .4 Corners: Radiused.

## **2.4 FABRICATION**

- .1 Set nails and countersink screws apply plain wood filler to indentations, sand smooth and leave ready to receive finish.
- .2 Provide cut-outs for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
- .3 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.
- .4 Obtain governing dimensions before fabricating items that are to accommodate or abut appliances, equipment and other materials.
- .5 Ensure adjacent parts of continuous laminate work match in colour and pattern.

- .6 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3000 mm.
- .7 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20°. Do not mitre laminate edges.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verify conditions of substrates are acceptable for architectural woodwork installation in accordance with manufacturer's instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

#### **3.2 INSTALLATION**

- .1 Perform architectural woodwork to Quality Standards of AWMAC.
- .2 Install prefinished millwork at locations shown on drawings.
  - .1 Position accurately, level, plumb, and straight.
- .3 Fasten and anchor millwork securely.
- .4 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.
- .5 At junction of plastic laminate counter and adjacent wall finish, apply small bead of sealant in accordance with Section 07 92 00 - Joint Sealants.
- .6 Fit hardware accurately and securely in accordance with manufacturer's written instructions.

#### **3.3 CLEANING**

- .1 Progress Cleaning: Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
  - .1 Clean cabinet work, outside surfaces, inside cupboards and drawers.
  - .2 Remove excess glue from surfaces.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**3.4 PROTECTION**

- .1 Protect woodwork from damage until final inspection.
- .2 Protect installed products and components from damage during construction.
- .3 Repair damage to adjacent materials caused by architectural woodwork installation.

**END OF SECTION**

## **Part 1        General**

### **1.1        REFERENCES**

- .1    ASTM International
  - .1    ASTM E2174-14 – Standard Practice for On-Site Inspection of Installed Firestops.
  - .2    ASTM G21-15, Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .2    Firestop Contractors International Association (FCIA)
  - .1    FCIA Firestop Industry Manual of Practice, 5<sup>th</sup> Edition.
- .3    FM Global (FM)
  - .1    FM Approvals 4991 – Approval of Firestop Contractors.
- .4    Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1    Material Safety Data Sheets (MSDS).
- .5    National Fire Protection Association (NFPA)
  - .1    NFPA 101 – Life Safety Code, 2009 Edition.
- .6    UL (formerly Underwriters Laboratories)
  - .1    UL 1479 – Standard for Fire Tests of Through-Penetration Firestops.
  - .2    UL 2079 – Standard for Tests for Fire Resistance of Building Joint Systems.
- .7    Underwriter's Laboratories of Canada (ULC)
  - .1    CAN/ULC S101-07 – Standard Methods of Fire Endurance Tests of Building Construction and Materials.
  - .2    CAN/ULC S102-07 – Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .3    CAN/ULC S115-05 - Fire Tests of Firestop Systems.

### **1.2        DEFINITIONS**

- .1    Fire Stop Material: Device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2    Single Component Fire Stop System: Fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3    Multiple Component Fire Stop System: Exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.



- .4 Tightly Fitted (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): Penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.
  - .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

### **1.3 PERFORMANCE REQUIREMENTS**

- .1 Materials, accessories, and application procedures: Listed by ULC, cUL, or tested in accordance with CAN/ULC S115 to comply with applicable building code requirements.
- .2 Firestopping materials: To CAN/ULC S101, to achieve fire rating as noted on Drawings and ULC Design Number shown.

### **1.4 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications, and datasheets. Include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets.
- .3 Shop Drawings:
  - .1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings, and method of installation.
  - .2 Ensure construction details accurately reflect actual job conditions.
- .4 System Design Listings, including illustrations from a qualified testing and inspection agency as applicable for each firestop configuration.
- .5 Samples:
  - .1 Submit duplicate 200 x 200 mm samples showing actual fire stop material proposed for project.
- .6 Quality Assurance Submittals: Submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Test reports: In accordance with CAN/ULC S101 for fire endurance and CAN/ULC S102 for surface burning characteristics.
    - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
  - .2 Certificates: Signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .3 Manufacturer's Instructions: Including special handling criteria, installation sequence, and cleaning procedures.

- .7 Project Record Documentation: Supply documentation for each single application addressed. Identify each penetration and joint location on entire project. Provide at completion of project.
  - .1 Include the following for through-penetrations:
    - .1 Sequential location number.
    - .2 Project name.
    - .3 Installation date.
    - .4 Detailed description of penetration location.
    - .5 Tested System or Engineered Judgment Number.
    - .6 Type of assembly penetrated.
    - .7 Detailed description of size and type of penetrating item.
    - .8 Size of opening.
    - .9 Number of sides of assemblies addressed.
    - .10 Hour rating achieved.
    - .11 Installer's name.
  - .2 Include the following for construction joints:
    - .1 Sequential location number.
    - .2 Project name.
    - .3 Installation date.
    - .4 Detailed description of construction joint location.
    - .5 Tested System or Engineered Judgment Number.
    - .6 Type of construction joint.
    - .7 Width of joint.
    - .8 Lineal footage of joint.
    - .9 Number of sides of assemblies addressed.
    - .10 Hour rating achieved.
    - .11 Installer's name.

## **1.5 QUALITY ASSURANCE**

- .1 Contractor: Company specializing in performing the work of this section, with at least one of the following qualifications:
  - .1 Approved in accordance with FM Standard 4991.
  - .2 FCIA Member in good standing.
  - .3 UL Approved Contractor.
  - .4 Licensed by the local authority having jurisdiction.
- .2 Single Source Responsibility: Obtain firestop systems for each type of penetration and construction situation from a single primary firestop systems manufacturer.
- .3 Regulatory Requirements:
  - .1 Conform to applicable code for fire resistance ratings and surface burning characteristics.

- .2 Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.
- .4 Pre-Installation Meetings: Convene pre-installation meeting one week prior to beginning work of this Section, with Departmental Representative in accordance with Section 01 32 16 - Construction Progress Schedule - Bar (GANTT) Chart to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building sub-trades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements, and with manufacturer's written instructions.
- .2 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC or cUL labels.
- .3 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .4 Replace defective or damaged materials with new.
- .5 Waste Management and Disposal:
  - .1 Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **1.7 SITE CONDITIONS**

- .1 Apply materials within temperature range recommended by manufacturer.
- .2 Maintain recommended temperature before, during, and for 72 hours after installation of materials.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Fire stopping and smoke seal systems: In accordance with CAN/ULC S115.
  - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke, and gases in compliance with requirements of CAN/ULC S115 and not to exceed opening sizes for which they are intended.
  - .2 Ensure firestopping system components are fully compatible with each other, with substrates, and with items penetrating the firestopping.
  - .3 Mould and mildew resistance to ASTM G21: 0 (Zero).
- .2 Service penetration assemblies: Systems tested to CAN/ULC S115.

- .3 Service penetration fire stop components: Certified by test laboratory to CAN/ULC S115.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: Elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork, and other mechanical items requiring sound and vibration control: Elastomeric seal.
- .7 Primers: To manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): Potable, clean, and free from injurious amounts of deleterious substances.
- .9 Insulation: Mineral wool fibre semi-rigid insulation, Type 1.
- .10 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.
- .11 Sealants for vertical joints: Non-sagging.
- .12 Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

### **Part 3 Execution**

#### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

#### **3.2 EXAMINATION**

- .1 Verify existing conditions before starting work.
- .2 Verify opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping are ready to receive the work of this Section.
- .3 Proceed with installation only when unsatisfactory conditions have been corrected.

#### **3.3 PREPARATION**

- .1 Ensure substrates and surfaces are clean, dry, and frost free.
- .2 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
- .3 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

- .4 Maintain insulation around pipes and ducts penetrating fire separation, without interruption to vapour barrier.
- .5 Mask and use drop cloths where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

### **3.4 INSTALLATION**

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated 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 neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

### **3.5 SEQUENCES OF OPERATION**

- .1 Proceed with installation only when submittals have been reviewed by Departmental Representative.
- .2 Install floor firestopping before interior partition erections.
- .3 Mechanical pipe insulation: Certified fire stop system component.
  - .1 Ensure pipe insulation installation precedes firestopping.

### **3.6 LABELLING**

- .1 Provide and install identification labels for each individual penetration with firestopping.
  - .1 Install labels in readily visible location, on both sides of penetrated assembly, with permanently bonding adhesive.
  - .2 Label to include:
    - .1 Warning indicating that system is firestopping installation to be left undisturbed.
    - .2 Installing Contractor name and contact information.
    - .3 System designation of testing organization.
    - .4 Installation date.
    - .5 Manufacturer.

### **3.7 FIELD QUALITY CONTROL**

- .1 Section 01 45 00: Quality Control.
- .2 Inspections: Notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

**3.8 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

**END OF SECTION**

**Part 1            General**

**1.1            REFERENCES**

- .1    ASTM International
  - .1    ASTM C834-05, Standard Specification for Latex Sealants.
  - .2    ASTM C919-12, Standard Practice for Use of Sealants in Acoustical Applications.
  - .3    ASTM C920-05, Standard Specification for Elastomeric Joint Sealants.
  - .4    ASTM C1193-13, Standard Guide for Use of Sealants.
  - .5    ASTM C1311-02, Standard Specification for Solvent Release Sealants.
  - .6    ASTM E814-13a, Standard Test Method for Fire Tests of Penetration Firestop Systems.
- .2    Canadian General Standards Board (CGSB)
  - .1    CAN/CGSB 19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
  - .2    CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.
  - .3    CAN/CGSB 19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
  - .4    CAN/CGSB 19.21-M87, Sealing and Bedding Compound, Acoustical.
  - .5    CAN/CGSB 19.24-M90, Multi-component, Chemical Curing Sealing Compound.
- .3    Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1    Material Safety Data Sheets (MSDS).

**1.2            SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1    Submit manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2    Manufacturer's product to describe:
    - .1    Caulking compound.
    - .2    Primers.
    - .3    Sealing compound, each type, including compatibility when different sealants are in contact with each other.
  - .3    Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29 - Health and Safety Requirements.

- .3 Samples:
  - .1 Submit 2 samples of each type of material in proposed colours for use in project.
  - .2 Cured samples of exposed sealants for each colour where required to match adjacent material.
- .4 Manufacturer's Instructions:
  - .1 Submit instructions to include installation instructions for each product used.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for incorporation into manual.

### **1.4 QUALITY ASSURANCE**

- .1 Compatibility: Verify sealants used are compatible with their respective joint substrates.
- .2 Provide sealants with appropriate expansion and contraction properties for the joints being sealed.

### **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

### **1.6 SITE CONDITIONS**

- .1 Ambient Conditions:
  - .1 Proceed with installation of joint sealants only when:
    - .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4°C.
    - .2 Joint substrates are dry.
    - .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.



- .2 Joint-Width Conditions:
  - .1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.
- .3 Joint-Substrate Conditions:
  - .1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

## **1.7 ENVIRONMENTAL REQUIREMENTS**

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Health Canada.
- .2 Departmental Representative to arrange for ventilation system to be operated on maximum outdoor air and exhaust during installation of caulking and sealants.

## **Part 2 Products**

### **2.1 SEALANT MATERIALS**

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2 When low toxicity caulks are not possible, confine usage to areas that off-gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off-gas time.
- .3 Where sealants are qualified with primers, use only indicated primers.

### **2.2 SEALANT MATERIALS**

- .1 Polyurethane Sealant: To CAN/CGSB 19.24, Type 2, Class B; and ASTM C920, Type M, Grade NS, Use NT, M, A and O; non-sag, multi component, chemical curing.
- .2 Elastomeric Polyurethane Sealant: To CAN/CGSB 19.13, Type 2; and ASTM C920, Type S, Grade NS, Use NT, M, A and O; non-sag, single component, moisture curing hybrid polyurethane.
  - .1 Perimeter caulking of windows and doors.
- .3 Latex Sealant: To CAN/CGSB 19.17; and ASTM C834; single component, acrylic latex or siliconized acrylic latex.
  - .1 General purpose, acoustic sealing, window frame perimeters.
- .4 Acoustic Sealant: To CAN/CGSB 19.21 and ASTM C919, acoustic grade, single component, non-hardening, non-skinning.
  - .1 Acoustic sealing of gypsum wall board partitions.
- .5 Acoustic and Smoke Sealant: To CAN/CGSB 19.21 and ASTM C919, acoustic grade, single component, non-hardening, non-skinning.
  - .1 Acoustic and smoke sealing of gypsum wall board partitions.

- .6 Fire-Resistive Sealant: To ASTM E814, one part firestopping sealant.
  - .1 Penetrations in fire-rated floor and wall assemblies.
  - .2 Refer to Section 07 84 00 – Firestopping.
- .7 Silicone, one part: To CAN/CGSB 19.13; and ASTM C920, Type S, Grade NS; mildew resistant, single component.
  - .1 Around washroom fixtures, lavatories, kitchenettes, and other wet areas.
- .8 Preformed compressible and non-compressible back-up materials:
  - .1 Polyethylene, urethane, neoprene or vinyl foam:
    - .1 Extruded closed cell foam backer rod.
    - .2 Size: oversize 30 to 50%.
  - .2 Neoprene or butyl rubber:
    - .1 Round solid rod, Shore A hardness 70.
  - .3 High density foam:
    - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m<sup>3</sup> density, or neoprene foam backer, size as recommended by manufacturer.
  - .4 Bond breaker tape:
    - .1 Polyethylene bond breaker tape that will not bond to sealant.
- .9 Primer: As recommended by sealant manufacturer, where required, for adhesion of sealant to substrate.

## **2.3 JOINT CLEANER**

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

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verify conditions of substrates are acceptable for joint sealants installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 SURFACE PREPARATION**

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

- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter that may impair Work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

### **3.3 PRIMING**

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime joint substrates as recommended by sealant manufacturer immediately prior to caulking.

### **3.4 BACKUP MATERIAL**

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

### **3.5 MIXING**

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

### **3.6 APPLICATION**

- .1 Sealant:
  - .1 Mask edges of joint where irregular surface or sensitive joint border exists, to provide neat joint.
  - .2 Apply sealant in continuous beads.
  - .3 Apply sealant using gun with proper size nozzle.
  - .4 Use sufficient pressure to fill voids and joints solid.
  - .5 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
  - .6 Tool exposed surfaces before skinning begins to give slightly concave shape.
  - .7 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing:
  - .1 Cure sealants in accordance with sealant manufacturer's instructions.
  - .2 Do not cover up sealants until proper curing has taken place.

### **3.7 CLEANING**

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

- .2 Clean adjacent surfaces immediately.
- .3 Remove excess and droppings, using recommended cleaners as work progresses.
- .4 Remove masking tape after initial set of sealant.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **3.8 PROTECTION**

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

**END OF SECTION**

DOOR						FRAME			FIRE RATING	HRDW SET	HARDWARE NOTES
NO.	NOMINAL SIZE	STC	MATERIAL	FINISH	TYPE	MATERIAL	FINISH	TYPE			
Suite 501B											
D501	EX	-	WD	EX	-	PS	PT1	EX	45 min	1	2
D502	915 x 2134	-	WD	CLEAR	1	PS	PT1	EX	-	3	2, 5
D504	915 x 2134	45	WD	CLEAR	2	PS	PT1	A	45 min	2	1, 6, 7
D506	EX	-	WD	EX	-	PS	PT1	EX	-	1	2
D507	915 x 2134	45	WD	CLEAR	1	PS	PT1	A	-	4	1
D508	EX	-	WD	EX	-	PS	PT1	EX	-	6	2
D509	EX	-	WD	EX	-	PS	PT1	EX	-	6	2
D510	EX	-	WD	EX	-	PS	PT1	EX	-	6	2
D511	915 x 2134	45	WD	CLEAR	2	PS	PT1	A	45 min	5	1, 4, 6
Corr 500A											
D500A-1	EX	-	WD	EX	-	PS	PT8	EX	-	EX	2
D500A-2	EX	-	WD	EX	-	PS	PT8	EX	-	EX	2
D500A-3	EX	-	WD	EX	-	PS	PT8	EX	-	EX	2
D500A-4	EX	-	WD	EX	-	PS	PT8	EX	-	EX	2
D500A-5	EX	-	WD	EX	-	PS	PT8	EX	-	EX	2
D501A-1	915 x 2134	45	WD	CLEAR	3	PS	PT8	B	45 min		1, 3
D500A-5	EX	-	WD	EX	-	PS	PT8	EX	-	EX	2

**LEGEND**

CLEAR   Clear stain      WD      Wood  
EX      Existing      PT      Paint  
PS      Pressed Steel

**NOTES**

1. Supply door & frame assembly. Assembly to be lab tested.
2. Existing door and frame to be reused. Repair door finish as required to satisfaction of Departmental Representative.
3. Relocate door hardware from D501A-9 (Suite 501A).
4. Corridor side of door and frame to match base building colours.
5. Provide new blind for glazing in door. Refer to Specificaiton Section 12 21 13.
6. Glazing in door to be fire glass.
7. Corridor side of door frame to be painted PT8.

## **Part 1 General**

### **1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM A653/A653M-08, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA)
  - .1 CSA G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door Manufacturers' Association (CSDMA)
  - .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frame Products, 2006.
  - .2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Door and Frame Products, 2009.
- .5 National Fire Protection Association (NFPA)
  - .1 NFPA 80-2007, Standard for Fire Doors and Other Opening Protectives.
  - .2 NFPA 252-12, Fire Tests of Door Assemblies.
- .6 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies.
  - .2 CAN4-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN/ULC S104.
  - .3 CAN/ULC S702-09, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
  - .4 CAN/ULC S704-03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

### **1.2 SYSTEM DESCRIPTION**

- .1 Design Requirements:
  - .1 Fire rated steel frames: Labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 or NFPA 252 for ratings specified or indicated.
  - .2 Provide labelled fire rated frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

### **1.3 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: Indicate door and frame configurations and finishes, location of cut-outs for hardware reinforcement.
- .3 Shop drawings:
  - .1 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings reinforcing, fire rating, finishes.
  - .2 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
  - .3 If required, submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan.
- .4 Samples:
  - .1 Submit one 250 x 250 mm corner sample of each type of frame.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
  - .1 Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Hot dipped galvanized steel sheet: To ASTM A653M, Z120 (G40), minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement channel: To CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

### **2.2 PRIMER**

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

### **2.3 PAINT**

- .1 Field paint steel frames in accordance with Section 09 91 00 – Painting. Provide final finish free of scratches and other blemishes.

### **2.4 ACCESSORIES**

- .1 Door Hardware: Specified in Section 08 71 00.
- .2 Door silencers: Single stud rubber/neoprene type.

- .3 Metallic paste filler: To manufacturer's standard.
- .4 Fire labels: Metal riveted.
- .5 Sealant: Refer to Section 07 92 00 – Joint Sealing.

## **2.5 FRAMES FABRICATION GENERAL**

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Interior frames: 1.6 mm welded type construction.
- .4 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .5 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .6 Conceal fastenings except where exposed fastenings are indicated.
- .7 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

## **2.6 FRAME ANCHORAGE**

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.
- .4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

## **2.7 FRAMES: WELDED TYPE**

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.
- .6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.



**Part 3            Execution**

**3.1                MANUFACTURER'S INSTRUCTIONS**

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

**3.2                INSTALLATION GENERAL**

- .1        Install labelled fire rated steel frames to NFPA 80 except where specified otherwise.
- .2        Install doors and frames to CSDMA Installation Guide.

**3.3                FRAME INSTALLATION**

- .1        Set frames plumb, square, level, and at correct elevation.
- .2        Secure anchorages and connections to adjacent construction.
- .3        Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4        Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5        Caulk perimeter of frames between frame and adjacent material.

**3.4                DOOR INSTALLATION**

- .1        Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
- .2        Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
  - .1        Hinge side: 1.0 mm.
  - .2        Latchside and head: 1.5 mm.
  - .3        Finished floor and thresholds: 13 mm.
- .3        Adjust operable parts for correct function.

**3.5                FINISH REPAIRS**

- .1        Touch up with primer finishes damaged during installation.
- .2        Fill exposed frame anchors surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

**END OF SECTION**

**Part 1        General**

**1.1        REFERENCES**

- .1 American National Standards Institute (ANSI)
  - .1 ANSI A208.2-2009 – Medium Density Fiberboard (MDF) for Interior Applications.
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC)
  - .1 Architectural Woodwork Standards, Edition 2, 2014.
- .3 Canadian Standards Association (CSA)
  - .1 CAN/CSA O132.2 Series-90 (R1998), Wood Flush Doors.
- .4 National Fire Protection Association (NFPA)
  - .1 NFPA 80-2007, Standard for Fire Doors and Other Opening Protectives.
  - .2 NFPA 252-2012, Fire Tests of Door Assemblies.
- .5 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN4-S104-M80, Fire Tests of Door Assemblies.
  - .2 CAN4-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

**1.2        SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications, data sheets and installation instructions. Include door core materials, thickness, construction, and veneer species.
  - .2 Submit WHMIS Material Safety Data Sheets. Indicate VOC content for door materials and adhesives.
- .3 Shop Drawings:
  - .1 Indicate door types, sizes, core construction, transom panel construction, locations, swings, undercuts, hardware locations, and preparation requirements, blocking for hardware in mineral core doors, fire ratings, finishes, and other pertinent data.
- .4 Samples:
  - .1 Submit one 300 x 300 mm corner sample of each type of wood door specified.
  - .2 Show door construction, faces, and core representative of specified door types.

- .5 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

### **1.3 QUALITY ASSURANCE**

- .1 Perform work to custom grade in accordance with requirements of AWMAC Architectural Woodwork Standards.
- .2 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

### **1.4 REGULATORY REQUIREMENTS**

- .1 Wood fire rated doors:
  - .1 Provide doors tested in compliance with CAN4-S104 or NFPA 252.
  - .2 Provide fire-rated wood doors with either ULC or ITS/Warnock Hersey label.
- .2 Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated.

### **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, protect, and handle products in compliance with AWMAC Architectural Woodwork Standards, and with manufacturer's recommendations.
- .2 Arrange for delivery after work causing abnormal humidity has been completed.
- .3 Accept doors on site in manufacturer's packaging. Inspect for damage.
- .4 Storage and Protection:
  - .1 Protect doors from dampness.
  - .2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.
  - .3 Protect doors from scratches, handling marks, and other damage.
  - .4 Store doors away from direct sunlight.

### **1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Do not dispose of unused paint material into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Ensure products contain no added urea formaldehyde resins and adhesives.

## **2.2 NON-RATED WOOD FLUSH DOORS**

- .1 Manufacture doors to ANSI/WDMA I.S. 1a-11 Heavy Duty performance level.
- .2 Solid core: To CAN/CSA O132.2, stile and rail frame, 5-ply construction.
  - .1 Particleboard to ANSI A208.2.
  - .2 Acoustic rated doors: Manufacturer's proprietary acoustical material.
- .3 Stiles: Softwood, AWMAC Type A solid wood, minimum 32 mm wide.
- .4 Rails: Structural composite lumber or softwood, minimum 51 mm wide.
- .5 Blocking for hardware: Softwood.
- .6 Face Panels:
  - .1 Face veneer: To match existing doors in project area.
- .7 Glazing stops: Same as door face veneer.
- .8 Glass: Refer to Section 08 80 50 – Glazing.
- .9 Adhesive: Type I waterproof PVA cross-link for interior doors.
- .10 Edges: Square.
- .11 Finish: Clear stain, refer to Section 09 91 00 – Painting.

## **2.3 FIRE RATED WOOD DOORS**

- .1 Tested in accordance with CAN4-S104 or NFPA 252 to achieve rating as indicated.
- .2 Solid core: To CAN/CSA O132.2, stile and rail frame, 5-ply construction.
  - .1 Core for rated doors: Fire rated mineral.
  - .2 Acoustic rated doors: Manufacturer's proprietary acoustical material.
    - .1 STC Rating: As scheduled.
- .3 Stiles, rails, and blocking: Fire rated composite, conforming to requirements of manufacturer's labelling agency.
- .4 Face Panels:
  - .1 Face veneer: To match existing doors in project area.
- .5 Glazing stops: Same as door face veneer.
- .6 Glass: Refer to Section 08 80 50 – Glazing.
- .7 Adhesive: Type I waterproof PVA cross-link for interior doors.
- .8 Edges: Square.
- .9 Finish: Clear stain, refer to Section 09 91 00 – Painting.

**Part 3            Execution**

**3.1                MANUFACTURER'S INSTRUCTIONS**

- .1        Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

**3.2                INSTALLATION**

- .1        Unwrap and protect doors in accordance with CAN/CSA O132.2 Series.
- .2        Install labelled fire rated doors to NFPA 80.
- .3        Install doors and hardware in accordance with manufacturer's printed instructions and CAN/CSA O132.2 Series.
- .4        Adjust hardware for correct function.
- .5        Install stops.

**3.3                ADJUSTMENT**

- .1        Re-adjust doors and hardware, just prior to substantial completion, to function freely and properly.

**3.4                CLEANING**

- .1        Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.
- .2        Remove traces of primer and caulking; clean doors and frames.
- .3        Clean glass and glazing materials with approved non-abrasive cleaner.
- .4        On completion of installation, remove surplus materials, rubbish, tools, and equipment barriers.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 National Fire Protection Association (NFPA)
  - .1 NFPA 80-2007, Fire Doors and Other Opening Protectives.
- .2 Underwriters Laboratory of Canada (ULC)
  - .1 CAN/ULC S104-10, Fire Tests of Door Assemblies.

**1.2 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for access door components. Include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings:
  - .1 Submit catalogue details for each type of door illustrating profiles, dimensions and methods of assembly. Indicate location and details of installation.
- .4 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Samples will be returned for inclusion into work.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for incorporation into manual.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect access doors from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 ACCESS PANELS**

- .1 Materials:
  - .1 Galvanized cold-rolled sheet steel.
- .2 Components:
  - .1 Frame: Carbon steel sheet, minimum 20 gauge, with tapping bead flange for installation to gypsum board substrate; concealed hinges.
    - .1 Weld exposed joints in flange and grind smooth.
  - .2 Door: Steel sheet, minimum 1.9 mm thick, reinforced to maintain flat surface.
    - .1 Ceiling mounted panels: Provide units with door closing spring and brackets.
  - .3 Lock: Flush, mortise cylinder lock.
  - .4 Finish: Baked enamel prime paint.
  - .5 Rated access panels: For fire rated wall assemblies, provide access panels complying NFPA 80 or CAN/ULC S104, with insulated construction.
- .3 Fabrication:
  - .1 Fabricate components straight, square, flat, with slightly rounded exposed edges.
  - .2 Ensure products are without burrs, snags, and sharp edges.
  - .3 Exposed welds continuous and ground smooth.
  - .4 Provide anchors or make provisions in frame for anchorage to adjacent construction. Provide adequate size, number, and location of anchors on all sides to secure access panel in opening.
- .4 Sizes: As indicated.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verify conditions of substrates are acceptable for access panel installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 PREPARATION**

- .1 Coordinate placement of access panels with mechanical, electrical, and plumbing trades.

- .2 Confirm placement of access panels with Departmental Representative, before proceeding with installation.

### **3.3 INSTALLATION**

- .1 Follow manufacturer's instructions for installation of access panels.
- .2 Locate access doors within view of equipment and ensure equipment is accessible for operating, inspecting, adjusting, servicing without using special tools.
- .3 Install panels level, plumb, and straight.

### **3.4 CLEANING**

- .1 Progress Cleaning: Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **3.5 PROTECTION**

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

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
  - .1 ANSI A117.1-2009, Standard for Accessible and Usable Buildings.
  - .2 ANSI/BHMA A156.1-2006, Butts and Hinges.
  - .3 ANSI/BHMA A156.4-2008, Door Control-Closers.
  - .4 ANSI/BHMA A156.5-2010, Cylinders and Input Devices for Locks.
  - .5 ANSI/BHMA A156.6-2010, Architectural Door Trim.
  - .6 ANSI/BHMA A156.13-2012, Mortise Locks and Latches Series 1000.
  - .7 ANSI/BHMA A156.16-2013, Auxiliary Hardware.
  - .8 ANSI/BHMA A156.115W, Hardware Preparation in Wood Doors with Wood or Steel Frames.
- .2 ASTM International
  - .1 ASTM F1577-05 (2012), Standard Test Methods for Detention Locks for Swinging Doors.
- .3 Canadian Standards Association (CSA)
  - .1 CSA B651-12 – Accessible Design for the Built Environment.
- .4 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)
  - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.
- .5 Underwriters Laboratories of Canada (ULC)
  - .1 CAN4-S104-M80, Fire Tests of Door Assemblies.

**1.2 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Samples will be returned for inclusion into work.
  - .3 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
  - .4 After approval, samples will be returned for incorporation in Work.

- .4 Hardware List:
  - .1 Submit contract hardware list.
  - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .5 Manufacturer's Instructions: Submit manufacturer's installation instructions.
- .6 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for door hardware for incorporation into manual.

### **1.4 QUALITY ASSURANCE**

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

### **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .4 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, well-ventilated area.
  - .2 Store and protect door hardware from nicks, scratches, and blemishes.
  - .3 Protect prefinished surfaces with wrapping or strippable coating.
  - .4 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 HARDWARE ITEMS**

- .1 Use one manufacturer's products only for similar items.

### **2.2 DOOR HARDWARE**

- .1 Locks and latches:

- .1 Mortise locks and latches: To BHMA A156.13, series 1000 mortise lock, Grade 1 and Security Grade 1. Meets impact requirements of ASTM F1577.
  - .1 Case: Wrought steel, zinc dichromate plated, 3 mm thick.
  - .2 Latchbolt: Stainless steel, minimum 19 mm throw.
  - .3 Strikes: To ANSI A115.1, curved lip.
  - .4 Lever: L-shaped, forged or cast.
  - .5 Rose: Round, heavy wrought.
  - .6 Finish: Satin chromium plated.
  - .7 Function:
    - .1 Storeroom lock: ANSI F07.
- .2 Cylinders:
  - .1 To BHMA A156.5, solid brass, 6 pin, to suit mortise lock. Finish: To match existing.
- .3 Hinges: To BHMA A156.1, five-knuckle, heavy weight, 0.180 gauge steel.
- .4 Door closers: To BHMA A156.4, Grade 1, and ANSI A117.1, rack and pinion operation, aluminum case, adjustable backcheck intensity.
  - .1 Arms: Heavy duty forged steel; type as scheduled.
- .5 Floor stops: To BHMA A156.16, solid cast brass, heavy duty casting with solid pin, complete with rubber bumper.
- .6 Wall stops: Brass, bronze, and stainless steel with rubber bumper, 63 mm diameter, 19 mm projection, concealed mounting.
  - .1 Bumper: Convex.
- .7 Architectural door trim: To BHMA A156.6.
  - .1 Door protection plates: Kick plate type 1.27 mm thick stainless steel, No. 4 finish.

## **2.3 FASTENINGS**

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.
- .4 Use fasteners compatible with material through which they pass.

## **2.4 KEYING**

- .1 Contact Departmental Representative for Keying Strategy.
- .2 Provide keys in triplicate for every lock.
- .3 Provide four master keys for each master key group.
- .4 Stamp keying code numbers on keys and cylinders.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Manufacturer's Instructions: Comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Supply door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Supply manufacturers' instructions for proper installation of each hardware component.
- .4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction) and CSA B651.
- .5 Where doorstop contacts door pulls, mount stop to strike bottom of pull.
- .6 Use only manufacturer's supplied fasteners.
  - .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

**3.2 ADJUSTING**

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to ensure tight fit at contact points with frames.

**3.3 CLEANING**

- .1 Progress Cleaning: in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
  - .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
  - .3 Remove protective material from hardware items where present.
  - .4 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**3.4 PROTECTION**

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

### 3.5 SCHEDULE

#### Set: 1.0

All Hardware Existing to Remain

Notes: Existing lock to be keyed to new master key system.

#### Set: 2.0

3 Hinge (heavy weight)	T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	8204 LNL	US26D	SA
1 Mortise Cylinder	To Match Existing Cylinders - key to new system	626	00
1 Electric Strike	310-2-3/4-24D-LCBMA	630	FO
1 Door Closer	1431 OZ	EN	SA
1 Drop Plate	1431B	EN	SA
1 Kick Plate	K1050 10"	US32D	RO
1 Wall Stop	406	US32D	RO
1 Weatherstrip/Sweep	All Weatherstrip by sound door supplier		00
1 Card Reader	By Others		00
1 Request to Exit Sensor	By Others		00
1 Power Supply	By Others		00

#### Set: 3.0

3 Hinge	TA2714 4-1/2" x 4"	US26D	MK
1 Storeroom Lock	8204 LNL	US26D	SA
1 Electric Strike	310-2-3/4-24D-LCBMA	630	FO
1 Door Closer	1431 O	EN	SA
1 Kick Plate	K1050 10"	US32D	RO
1 Wall Stop	406	US32D	RO
1 Card Reader	By Others		00
1 Request to Exit Sensor	By Others		00
1 Power Supply	By Others		00

**Set: 4.0**

3 Hinge (heavy weight)	T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	8204 LNL	US26D	SA
1 Mortise Cylinder	To Match Existing Cylinders - key to new system	626	00
1 Electric Strike	310-2-3/4-24D-LCBMA	630	FO
1 Concealed Overhead Stop	6ADJ-X36	630	RF
1 Door Closer	1431 OZ	EN	SA
1 Drop Plate	1431B	EN	SA
1 Kick Plate	K1050 10"	US32D	RO
1 Weatherstrip/Sweep	All Weatherstrip by sound door supplier		00
1 Card Reader	By Others		00
1 Request to Exit Sensor	By Others		00
1 Power Supply	By Others		00

**Set: 5.0**

3 Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	8204 LNL	US26D	SA
1 Mortise Cylinder	To Match Existing Cylinders - key to new system	626	00
1 Electric Strike	310-2-3/4-24D-LCBMA	630	FO
1 Concealed Overhead Stop	6ADJ-X36	630	RF
1 Door Closer	1431 O	EN	SA
1 Kick Plate	K1050 10"	US32D	RO
1 Weatherstrip/Sweep	All Weatherstrip by sound door supplier		00
1 Card Reader	By Others		00
1 Request to Exit Sensor	By Others		00
1 Power Supply	By Others		00

**Set: 6.0**

1 Electric Strike	8300C-LBM	630	HS
1 Card Reader	By Others		00
1 Request to Exit Sensor	By Others		00
1 Power Supply	By Others		00
Balance of Hardware is Existing to Remain			

Notes: Existing lock to be keyed to new master key system. If existing lock is a passage set replace with AL80 storeroom lock. Confirm electric strike shown will fit in existing frame prep prior to ordering.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM C542-05 (2011), Standard Specification for Lock-Strip Gaskets.
  - .2 ASTM D2240-05 (2010), Standard Test Method for Rubber Property - Durometer Hardness.
  - .3 ASTM E84-14, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 12.1-M90, Tempered or Laminated Safety Glass.
  - .2 CAN/CGSB 12.11-M90, Wired Safety Glass.
- .3 Glass Association of North American (GANA)
  - .1 GANA Glazing Manual – current edition.
  - .2 GANA Laminated Glazing Reference Manual - 2009.

**1.2 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for glass, sealants, and glazing accessories; include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for glazing for incorporation into manual.

**1.4 DELIVERY, STORAGE, AND HANDLING**

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



- .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect glazing and frames from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

## **1.5 AMBIENT CONDITIONS**

- .1 Ambient Requirements:
  - .1 Install glazing when ambient temperature is 10°C minimum. Maintain ventilated environment for 24 hours after application.
  - .2 Maintain minimum ambient temperature before, during, and 24 hours after installation of glazing compounds.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Safety glass: To CAN/CGSB 12.1, transparent, 6 mm thick.
  - .1 Type 2-tempered.
  - .2 Class B-float.
  - .3 Category 11.
  - .4 Edge treatment.
- .2 Fire glass: Laminated ceramic glass, clear, wireless, 8 mm thick, fire rating to meet requirements of assembly.
  - .1 Impact safety resistant to ANSI Z97.1 and CPSC 16CFR1201 (Cat I and II).
- .3 Sealant: In accordance with Section 07 92 00 - Joint Sealants.

### **2.2 ACCESSORIES**

- .1 Setting blocks: Neoprene, 80-90 Shore A durometer hardness to ASTM D2240, to suit glazing method, glass light weight and area.
- .2 Spacer shims: Neoprene, 50-60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self-adhesive on one face.
- .3 Glazing tape: Preformed butyl compound with integral resilient tube spacer, 10-15 Shore A durometer hardness to ASTM D2240; coiled on release paper; widths as required for application, black colour.
- .4 Glazing splines: Resilient silicone, extruded shape to suit glazing channel retaining slot.
- .5 Glazing clips: Manufacturer's standard type.
- .6 Lock-strip gaskets: To ASTM C542.

**Part 3            Execution**

**3.1                EXAMINATION**

- .1    Verify conditions of substrates are acceptable for glazing installation in accordance with manufacturer's written instructions.
  - .1    Verify openings for glazing are correctly sized and within tolerance.
  - .2    Verify surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
  - .3    Visually inspect substrate.
  - .4    Inform Departmental Representative of unacceptable conditions.
  - .5    Proceed with installation only after unacceptable conditions have been remedied.

**3.2                PREPARATION**

- .1    Clean contact surfaces with solvent and wipe dry.
- .2    Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3    Prime surfaces scheduled to receive sealant.

**3.3                INSTALLATION: EXTERIOR - DRY METHOD (PREFORMED GLAZING)**

- .1    Manufacturer's Instructions: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2    Perform work in accordance with GANA Glazing Manual and GANA Laminated Glazing Reference Manual for glazing installation methods.
- .3    Cut glazing tape or spline to length; install on glazing light. Butt-joint tape or spline and seal junctions with sealant.
- .4    Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.
- .5    Rest glass unit on setting blocks; apply pressure against fixed stop for full continuous contact.
- .6    Install removable stops without displacing glazing tape or spline. Apply pressure for full continuous contact.
- .7    Trim protruding tape edge flush with stop.

**3.4                INSTALLATION: INTERIOR WET/DRY METHOD (TAPE AND SEALANT)**

- .1    Perform work in accordance with GANA Glazing Manual and GANA Laminated Glazing Reference Manual for glazing installation methods.
- .2    Cut glazing tape to length and install against permanent stops, projecting 1.6 mm above sight line.
- .3    Place setting blocks at 1/4 points, with edge block maximum 150 mm from corners.

- .4 Set glass unit on setting blocks and apply pressure against tape for full contact at perimeter of light or unit.
- .5 Install removable stops, with spacer shims inserted between glazing and applied stops at 600 mm intervals, 6 mm below sight line.
- .6 Fill gaps between glass and applied stop with sealant to depth equal to bite of frame on glazing, to uniform and level line. Tool sealant
- .7 Trim protruding tape edge.

### **3.5 CLEANING**

- .1 Progress Cleaning: Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
    - .1 Remove traces of primer, caulking.
    - .2 Remove glazing materials from finish surfaces.
    - .3 Remove labels.
    - .4 Clean glass using approved non-abrasive cleaner in accordance with manufacturer's instructions.
  - .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **3.6 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 After installation, mark each light with an "X" by using removable plastic tape or paste.
- .3 Repair damage to adjacent materials caused by glazing installation.

### **3.7 SCHEDULE**

- .1 Sidelight and clerestory light glazing:
  - .1 Tenant Space side glass: 6 mm tempered glass.
  - .2 Spacer: 55 mm, acoustical lining.
  - .3 Public Corridor side glass: 8 mm fire glass.
  - .4 Frame cavity fill: Expanding polyurethane foam.
- .2 Door lights:
  - .1 Fire rated: 8 mm fire glass.
  - .2 Non-rated: 6 mm tempered glass.

**END OF SECTION**

NO.	ROOM NAME	FLOOR	BASE	CEILING		WALL								NOTES
		Material	Mat.	Material	Fin.	NORTH		EAST		SOUTH		WEST		
						Material	Fin.	Material	Fin.	Material	Fin.	Material	Fin.	
501	Waiting Room	VT1	RB1	ACT	-	EX	PT2	EX	PT2	EX	PT2	GWB	PT4	4
502	Exam Room	SV1	CB	ACT	-	EX	PT1	EX	PT3	EX	PT5	EX/GWB	PT1	4, 5
503	Reception	CPT1	RB1	ACT	-	GWB	PT1	EX/GWB	PT2	N/A	-	GWB	PT1	4
504	Shared Equipment	CPT1	RB1	ACT	-	N/A	-	EX/GWB	PT1/3	EX	PT3/5	N/A	-	4
505	Kitchen	VT1	RB1	EX	EX	EX	PT2	EX	PT4	EX/GT	PT2/-	EX	PT2	3
506	LAN Room	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	EX	3
507	Open Area	CPT1	RB1	EX/ACT	EX/-	EX	PT1	EX/GWB	PT1/3/5	EX	3	EX	PT1	1, 3
508	Office	CPT1	RB1	EX	EX	EX	PT1	EX	PT1	EX	PT1	EX	PT3	1, 3
509	Interview Room	CPT1	RB1	EX	EX	EX	PT1	EX	PT1	EX	PT1	EX	PT4	1, 3
510	Boardroom	CPT1	RB1	EX/ACT	EX/-	EX	PT1	GWB	PT3	EX	PT1	EX	PT3	1, 3, 4
511	OSSIS Office	CPT1	RB1	ACT	-	EX	PT1	EX	PT3	EX	PT1	GWB	PT1	1, 3, 4
500A	Public Corridor	PC1	PC1	GWB	PT7	EX	PT7	EX	PT7	EX	PT7/9	EX/GWB	PT7/9	1, 2, 3, 4

#### **LEGEND**

ACT	Acoustic Ceiling Tile	PT	Paint
CPT	Carpet Tile	RB	Rubber Base
EX	Existing	SV	Sheet Vinyl
VT	Vinyl Tile	PC	Porcelain Tile
GT	Glass Tile	CB	Cove Base
GWB	Gypsum Wall Board		

#### **NOTES**

- Existing radiator to be painted. Radiators within Suite 501B to be painted PT1.
- Patch and repair existing ceiling grid as required where affected by demolition to satisfaction of Departmental Representative.
- Replace damaged tiles as required to satisfaction of Departmental Representative.
- New ACT to match existing ceiling tile and grid.
- Cove base c/w cap. Refer to Specification Section 09 65 16.
- Door frames in Corr 500A to be painted PT8.
- Existing radiators to be painted. Radiators in Corr 500A to be painted PT7.

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM C475/C475-12e1, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
  - .2 ASTM C754-15, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
  - .3 ASTM C840-13, Standard Specification for Application and Finishing of Gypsum Board.
  - .4 ASTM C954-11, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
  - .5 ASTM C1002-14, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
  - .6 ASTM C1047-14a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
  - .7 ASTM C1396/C1396M-14a, Standard Specification for Gypsum Wallboard.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.34-M86 (R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Gypsum Association (GA)
  - .1 GA-214-15, Recommended Levels of Finish for Gypsum Board, Glass Mat, and Fiber-Reinforced Gypsum Panels.
  - .2 GA-216-13, Application and Finishing of Gypsum Panel Products.
- .4 Underwriters' Laboratories
  - .1 UL 752-2005, Standard for Bullet-Resisting Equipment.
- .5 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC S101-07, Fire Endurance Tests of Building Construction and Materials.

**1.2 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies. Include product characteristics, performance criteria, physical size, finish, and limitations.

### **1.3 REGULATORY REQUIREMENTS**

- .1 Conform to applicable code for fire rated assemblies in conjunction with Section 09 22 16 as follows:
  - .1 Fire resistance classifications to CAN/ULC S101.
  - .2 Fire rated Design Assembly No. as listed on Drawings.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver materials to site in original packaging, labelled with manufacturer's name and identification.
- .3 Storage and Handling Requirements:
  - .1 Store gypsum board assemblies materials level off ground and indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.
  - .3 Protect from weather, elements and damage from construction operations.
  - .4 Handle gypsum boards to prevent damage to edges, ends or surfaces.
  - .5 Protect prefinished aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
  - .6 Replace defective or damaged materials with new.

### **1.5 AMBIENT CONDITIONS**

- .1 Maintain temperature 10°C minimum, 21°C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.
- .2 Apply board and joint treatment to dry, frost-free surfaces.
- .3 Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Standard gypsum board: ASTM C1396/C1396M, Type X, thickness as shown on Drawings, 1200 mm wide x maximum practical length, ends square cut.
- .2 Bulletproof panels: Laminated fibre reinforced plastic panels composed of woven roving ballistic grade fibreglass cloth impregnated with thermoset polyester resin, compressed into flat rigid sheets.
  - .1 Panel rating: To UL752, Level 3.

- .3 Metal furring runners, hangers, tie wires, inserts, anchors: To ASTM C754.
- .4 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.
- .5 Steel drill screws: ASTM C1002.
- .6 Casing beads, corner beads, control joints and edge trim: To ASTM C1047, metal, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one piece length per location.
- .7 Acoustic sealants: In accordance with Section 07 92 00 - Joint Sealing.
- .8 Acoustic gasket: Closed-cell rubber or PVC tape, with pressure sensitive adhesive, peel-away backing.
- .9 Joint tape: ASTM C475, 52 mm wide fibre paper tape.
- .10 Joint compound: ASTM C475, asbestos-free.

## **2.2 FRAMING MATERIALS**

- .1 Studs and Tracks: As specified in Section 09 22 16.
- .2 Furring, framing, and accessories: ASTM C645.
- .3 Anchorage to substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application, and to rigidly secure materials in place.
  - .1 Tie wire: To ASTM C754.
  - .2 Hangers: To ASTM C754, galvanized.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verify conditions of substrates are acceptable for installation of gypsum board assemblies in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 APPLICATION**

- .1 Install bullet resistive material in accordance with manufacturer's printed instructions.
- .2 Apply and finish gypsum board to ASTM C840 or GA-216 except where specified otherwise.
- .3 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical work, and mechanical work have been approved.
- .4 Apply gypsum board in most economical direction, with ends and edges occurring over firm bearing.

- .5 Install furring, if required, for fire resistance ratings indicated.
- .6 Furr openings in accordance with Section 06 10 00 – Rough Carpentry.
- .7 Apply gypsum board to furring or framing using screw fasteners. Maximum spacing of screws 300 mm on centre.
  - .1 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
- .8 Install fire rated gypsum board in accordance with applicable ULC design number.
- .9 Apply board using stud adhesive on furring or framing.
- .10 Install gypsum board with face side out.
- .11 Do not install damaged or damp boards.
- .12 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

### **3.3 INSTALLATION - GENERAL**

- .1 For bulletproof panels, reinforce joints with back-up layer of bullet resistive material.
  - .1 Reinforcing layer: Minimum width 100 mm, centered on panel joints.
- .2 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure using contact adhesive for full length.
- .3 Install casing beads around perimeter of suspended ceilings.
- .4 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .5 Splice corners and intersections together and secure to each member with 3 screws.
- .6 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape, and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .7 Place corner beads at external corners.
  - .1 Use longest practical length.
  - .2 Place edge trim where gypsum board abuts dissimilar materials.
- .8 Finish gypsum board walls and ceilings to following levels in accordance with GA-214:
  - .1 Levels of finish:
    - .1 Level 1 - in concealed areas: embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.
    - .2 Level 4 - in exposed areas: embed tape for joints and interior angles in joint compound and apply three separate coats of joint



compound over joints, angles, fastener heads and accessories;  
surfaces smooth and free of tool marks and ridges.

- .9 Finish corner beads, and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .10 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .11 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .12 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

### **3.4 CEILING INSTALLATION**

- .1 Install to ASTM C754 or GA-216.
- .2 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840 except where specified otherwise.
- .3 Install ceiling framing independent of walls, columns, and above ceiling work.
- .4 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.
- .5 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .6 Install work level, to tolerance of 1:1200.
- .7 Coordinate location of hangers with other work.
- .8 Reinforce openings in ceiling suspension system that interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 600 mm past each end of openings.
- .9 Laterally brace entire suspension system.
- .10 Locate control joints at approximate 15 m spacing on ceilings.

### **3.5 ACOUSTIC ACCESSORIES INSTALLATION**

- .1 Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
- .2 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partition to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, and in partitions where perimeter sealed with acoustic sealant.
- .3 Apply acoustic gasket tape to top of installed gypsum board to seal joints with acoustic ceiling tile.

**3.6 TOLERANCES**

- .1 Maximum variation of finished gypsum board surface from true flatness: 3 mm in 3 m, in any direction.

**3.7 CLEANING**

- .1 Progress Cleaning: Clean in accordance with Section 01 74 11 - Cleaning. Leave Work area clean at end of each day.
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**3.8 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by installation of gypsum board assemblies.

**END OF SECTION**

**Part 1 General****1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM C645-14, Standard Specification for Nonstructural Steel Framing Members.
  - .2 ASTM C754-11, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

**1.2 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal framing. Include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 QUALITY ASSURANCE**

- .1 Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect metal framing from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products****2.1 MATERIALS**

- .1 Non-load bearing channel stud framing: To ASTM C645, stud size as shown on drawings, roll formed from hot dipped galvanized steel sheet, for screw attachment of gypsum board.
  - .1 Base steel thickness:
    - .1 Framing for transaction window: 1.15 mm (18 gauge).
    - .2 General framing: 0.866 mm (20 gauge).

- .2 Knock-out service holes at 460 mm centres.
- .3 Floor and ceiling tracks: In widths to suit stud sizes, 32 mm flange height.
- .2 Metal channel stiffener: 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.
- .3 Acoustical sealant: In accordance with Section 07 92 00 - Joint Sealants.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verify that conditions of substrate are acceptable for non-structural metal framing application in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

#### **3.2 ERECTION**

- .1 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.
- .2 Place studs vertically at 400 mm on centre and not more than 50 mm from abutting walls, and at each side of openings and corners.
  - .1 Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .3 Erect metal studding to tolerance of 1:1000.
- .4 Install two continuous 12 mm wide beads of acoustical sealant under tracks around perimeters of sound control partitions.
- .5 Attach studs to bottom track using screws.
- .6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .7 Co-ordinate erection of studs with installation of door frames and special supports or anchorage for work specified in other Sections.
- .8 Install heavy gauge single jamb studs at openings.
- .9 Erect track at head of door openings and sills of sidelight/window openings to accommodate intermediate studs.
  - .1 Secure track to studs at each end, in accordance with manufacturer's instructions.
  - .2 Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .10 Frame openings and around built-in equipment and cabinets on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

- .11 Extend partitions to ceiling height except where noted otherwise on drawings.
- .12 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.
  - .1 Use double track slip joint.

### **3.3 CLEANING**

- .1 Progress Cleaning: Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **3.4 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by non-structural metal framing application.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)
  - .1 ANSI A108/A118/A136.1-2014, Specifications for the Installation of Ceramic Tile.
  - .2 ANSI A137.1:2012, American National Standard Specifications for Ceramic Tile.
  - .3 ANSI A137.2:2013, American National Standard Specifications for Glass Tile.
- .2 ASTM International
  - .1 ASTM C979/C979M-10, Standard Specification for Pigments for Integrally Coloured Concrete.
  - .2 ASTM E1155/E1155M-14, Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 75.1-M88, Tile, Ceramic.
- .4 Terrazzo Tile and Marble Association of Canada (TTMAC)
  - .1 Tile Specification Guide 09 30 00, Tile Installation Manual 2016-2017.

**1.2 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data:
  - .1 Include manufacturer's information on:
    - .1 Ceramic tile, marked to show each type, size, and shape required.
    - .2 Trim profiles.
    - .3 Transition strips.
    - .4 Bond coat.
    - .5 Levelling compound.
    - .6 Latex cement mortar and grout.
    - .7 Uncoupling membrane.
    - .8 Slip-resistant tile.
- .3 Samples:
  - .1 Wall and floor tile: submit duplicate, full-sized samples of each colour, texture, size, and pattern of tile specified.
  - .2 Trim profiles and transition strips: Submit duplicate 100 mm (4 inch) minimum manufacturer samples, showing profile, material, and finish.
  - .3 Grout: Submit duplicate manufacturer samples representative of grout colour.

### **1.3 QUALITY ASSURANCE**

- .1 Conform to TTMAC Tile Installation Manual.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
  - .1 Remove waste material in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **1.5 AMBIENT CONDITIONS**

- .1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12°C for 48 hours before, during, and 48 hours after, installation.
- .2 Do not install tiles at temperatures less than 12°C or above 38°C.

### **1.6 MAINTENANCE**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Provide minimum 2% of each type and colour of tile required for project for maintenance use. Store where directed.
  - .3 Maintenance material same production run as installed material.

## **Part 2 Products**

### **2.1 FLOOR TILE**

- .1 Porcelain tile (PC):
  - .1 Dimensions: Nominal 600 x 600 mm (24 x 24 inches).
  - .2 Dynamic coefficient of friction in accordance with ANSI A137.1: Minimum 0.60.
  - .3 Installation: Stacked pattern.
  - .4 Base: Cut field tile to 100 mm height.
  - .5 Product: C & S Tile Downtown Series.
    - .1 Colour: Earth DWR01150.

### **2.2 WALL TILE**

- .1 Glass tile (GT): Through-colour, matte finish.
  - .1 Dimensions: Nominal 50 x 300 mm (2 x 12 inches).
    - .1 Colour: As selected by Departmental Representative.

## **2.3 SURFACE PREPARATION MATERIALS**

- .1 Sub-floor filler and leveller: Self-levelling cementitious compound capable of bonding to properly prepared substrate surfaces.
  - .1 Compressive strength: Minimum 36.5 MPa (5300 psi) at 28 days.
  - .2 Capable of being walked on without damage after 3 hours.
  - .3 Capable of being coated after 24 hours at 21°C.

## **2.4 BOND COAT**

- .1 Glass tile mortar:
  - .1 Thin set interior installation: Polymer modified mortar, non-sag, bright white, unsanded, meeting shear bond strength requirements of ANSI A118.4.
- .2 Floor tile systems:
  - .1 Thin set interior installation: Unmodified Portland cement mortar meeting or exceeding requirements of ANSI A118.1, rated for floor traffic load bearing performance.

## **2.5 GROUT**

- .1 Glass tile (GR1): To ANSI A118.6 and ANSI A118.7, premium polymer-modified Portland cement-based grout, unsanded, mould and mildew resistant.
  - .1 Colour: As selected by Departmental Representative.
  - .2 Grout line for glass tile: 2 mm.
- .2 Floor tile (GR2): To ANSI A118.6 and ANSI A118.7, premium polymer-modified Portland cement-based grout, sanded, mould and mildew resistant.
  - .1 Colour: As selected by Departmental Representative.
  - .2 Grout line for floor tile: 3 mm.
- .3 Colouring Pigments:
  - .1 Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.
  - .2 Colouring pigments to be added to grout by manufacturer.
  - .3 Job coloured grouts are not acceptable.

## **2.6 ACCESSORIES**

- .1 Uncoupling membrane: Polyethylene membrane, 3 mm thick, with grid structure of square cavities cut back in dovetail configuration; anchoring fleece laminated to underside.
- .2 Trim profiles: Extruded aluminum, L-shaped profile with 3.2 mm (1/8 inch) wide top section, integrated perforated anchoring leg, and integrated grout joint spacer; brushed anodized finish. Height as required.
- .3 Transition strips: Purpose-made extruded clear satin anodized aluminum edge strips; height as required to suit installation and provide smooth transition



between floor finish transitions; with integral perforated anchoring leg for setting strip into setting material. Provide strips for transitions:

- .1 Ceramic tile to porcelain tile.
- .2 Porcelain tile to carpet tile.
- .3 Porcelain tile to existing vinyl composite tile.
- .4 Expansion joints: Profile with integrated rigid PVC, perforated anchoring legs; soft 5 mm wide chlorinated polyethylene (CPE) centre. Height as required.
  - .1 Colour: Matched to grout.
- .5 Sealant: In accordance with Section 07 92 00 - Joint Sealants.

## **2.7 CLEANING COMPOUNDS**

- .1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and levelling compounds.
- .2 Materials containing acid or caustic material are not acceptable.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

### **3.2 EXAMINATION**

- .1 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.
- .2 Confirm flatness of substrate by measurements taken in accordance with ASTM E1155/E1155M.
  - .1 Composite flatness ( $F_F$ ): Minimum 35.
  - .2 Composite levelness ( $F_L$ ): Minimum 25.

### **3.3 TILE INSTALLATION - GENERAL**

- .1 Perform tile work in accordance with TTMAC Tile Installation Manual, except where specified otherwise.
- .2 Apply tile to clean and sound surfaces.
- .3 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.
- .4 Maximum surface tolerance 1:800.
- .5 Knock down trowel ridges and back butter glass tile to ensure ridges are not visible through installed tile.

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- .6 Make joints between tile uniform and approximately 2 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.
- .7 Remove excess mortar from tile joint areas so at least 2/3 of the tile depth remains for grouting.
- .8 Lay out tiles so perimeter tiles are minimum 1/2 size.
- .9 Sound tiles after setting and replace hollow-sounding units to obtain full bond.
- .10 Install trim profiles as indicated.
- .11 Install transition strips at junction of tile flooring and dissimilar materials.
- .12 Allow minimum 24 hours after installation of tiles, before grouting.
- .13 Clean installed tile surfaces after installation and grouting is cured.
- .14 Install control joints at 4800 mm (16 feet) spacing. Keep building expansion joints free of mortar and grout.

**3.4 WALL TILE**

- .1 Install in accordance with TTMAC detail 304W.

**3.5 FLOOR TILE**

- .1 Install in accordance with TTMAC detail 311F, Detail C.
- .2 Install cut-down field tile as wall base; add trim profile for base cap.

**3.6 FLOOR SEALER AND PROTECTIVE COATING**

- .1 Apply in accordance with manufacturer's instructions.

**3.7 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

**Part 1 General**

- .1 ASTM International
  - .1 ASTM A641/A641M-09a (2014) – Standard Specification for Zinc-Coated/Galvanized Carbon Steel Wire.
  - .2 ASTM C423-09a, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
  - .3 ASTM C635/C635M-13a, Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
  - .4 ASTM C636/C636M-13, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
  - .5 ASTM E1264-14, Standard Classification for Acoustical Ceiling Products.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-92.1-M89, Sound Absorptive Prefabricated Acoustical Units.
- .3 Canadian Standards Association (CSA)
  - .1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .5 Underwriter's Laboratories of Canada (ULC)
  - .1 CAN/ULC S102-07, Surface Burning Characteristics of Building Materials and Assemblies.

**1.2 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications, and data sheets.
- .3 Samples:
  - .1 Samples: Submit two (2) samples, 200 x 200 mm, illustrating material and finish of acoustic units.
  - .2 Samples: Submit two (2) samples of suspension system, 300 mm (12 inches) long.
- .4 Installation Data: Provide manufacturer's special installation requirements.

**1.3 QUALITY ASSURANCE**

- .1 Regulatory Requirements:

- .1 Fire-resistance rated floor/ceiling and roof/ceiling assembly: certified by Canadian Certification Organization accredited by Standards Council of Canada.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver acoustical ceiling units to project site in unopened manufacturer's packaging. Store in enclosed space and protect from damage.
- .2 Protect on-site stored or installed absorptive material from moisture damage.
- .3 Store extra materials required for maintenance, where directed by Departmental Representative.
- .4 Waste Management and Disposal:
  - .1 Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### **1.5 ENVIRONMENTAL REQUIREMENTS**

- .1 Permit wet work to dry before beginning installation.
- .2 Maintain uniform minimum temperature of 15°C and humidity of 20% before and during installation.
- .3 Store materials in work area 48 hours prior to installation.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Acoustic Ceiling Tile Suspension System:
  - .1 Non-fire Rated Grid: ASTM C635/C635M, intermediate duty cold rolled steel with hot dipped galvanized coating; components die cut and interlocking.
  - .2 Fire Rated Grid: ASTM C635/C635M, intermediate duty cold rolled steel with hot dipped galvanized coating; listed by ULC/UL for use in fire-rated assembly; components die cut and interlocking.
  - .3 Grid Materials: Commercial quality cold rolled steel with galvanized coating.
  - .4 Edge Profile: Square, to match existing.
  - .5 Grid Finish: Painted white.
- .2 Acoustic units for suspended ceiling system: To CAN/CGSB 92.1 and ASTM E1264.
  - .1 Type III, Form 2, Pattern C, D.
  - .2 Fire Class A.
  - .3 Composition: Wet-formed mineral fibre. Pattern: Random textured.
  - .5 Fire ratings to CAN/ULC S102:
    - .1 Flame spread: Maximum 25.

- .2 Smoke developed: Maximum 50.
- .6 Noise Reduction Coefficient (NRC) to ASTM C423: Minimum 0.55.
- .7 Ceiling Attenuation Class (CAC) rating to ASTM E1414/E1414M: Minimum 35.
- .8 Light Reflectance (LR): 0.82.
- .9 Edge type: Square.
- .10 Colour: White.
- .11 Size: 610 x 1219 x 16 mm (24 x 48 x 5/8 inches).
- .12 Surface coverings: Factory applied latex paint.
- .13 Acceptable product: Armstrong Contractor Series 933.
- .1 This product is a base building standard, no substitutions will be considered.
- .3 Adhesive: Low VOC type recommended by acoustic unit manufacturer.
- .4 Staples, nails and screws: To CSA B111, non-corrosive finish as recommended by acoustic unit manufacturer.
- .5 Hold down clips: Purpose made clips to secure tile to suspension system, approved for use in fire-rated systems.
- .6 Adhesives and mounting accessories as recommended by manufacturer.
- .7 Attachment devices: Size for five times design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated.
- .8 Wire for hangers and ties: To ASTM A641/A641M, Class 1 zinc coating, soft annealed, with yield stress load at least 3 times design load, but not less than 12 gauge.
- .9 Touch-Up Paint: Type and colour to match acoustic and grid units.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Do not install acoustical panels and tiles until work above ceiling has been inspected by Departmental Representative.
- .2 Verify conditions of substrates are acceptable for acoustic panel ceiling installation in accordance with manufacturer's instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 INSTALLATION**

- .1 Install acoustical tiles and ceiling suspension system in accordance with manufacturer's written instructions.

- .2 In fire rated ceiling systems, secure lay-in panels with hold-down clips and protect over light fixtures, diffusers, air return grilles and other appurtenances according to Certification Organizations design requirements.

### **3.3 APPLICATION**

- .1 Install acoustic units to clean, dry and firm substrate.
- .2 Install acoustical units as indicated in reflected ceiling plan.
- .3 Scribe acoustic units to fit adjacent work. Butt joints tight.

### **3.4 INTERFACE WITH OTHER WORK**

- .1 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM D2047-11, Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
  - .2 ASTM E662-12, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
  - .3 ASTM E1155-14/E1155M-14, Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers.
  - .4 ASTM F386-11, Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces.
  - .5 ASTM F410-08 (203), Standard Test Method for Wear Layer Thickness of Resilient Floor Coverings by Optical Measurement.
  - .6 ASTM F970-07 (2011), Standard Test Method for Static Load Limit.
  - .7 ASTM F1066-04 (2014)e1, Standard Specification for Vinyl Composition Floor Tile.
  - .8 ASTM F1861-08 (2012)e1 – Standard Specification for Resilient Wall Base.
  - .9 ASTM F1913-04 (2014), Standard Specification for Vinyl Sheet Floor Covering Without Backing.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.2 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for tile adhesive, subfloor patching compound. Include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2 Submit 2 copies of WHMIS MSDS for products to be installed.
- .3 Samples:
  - .1 Submit duplicate sample resilient vinyl tiles, full size, in proposed colours and patterns.
  - .2 Submit duplicate 300 x 300 mm pieces of sheet vinyl material, in proposed colours and patterns.
  - .3 Submit duplicate 300 mm lengths of base, full width, demonstrating colour and profile.
  - .4 Submit duplicate 100 mm pieces of transition strip in proposed colours and finish.

- .4 Shop Drawings: Indicate:
  - .1 Tile installation orientation.
  - .2 Sheet installation orientation.
  - .3 Seaming plan for sheet material.
  - .4 Cut-outs: Show locations where cut-outs are required.
  - .5 Edgings: Show location of edge mouldings.
- .5 Closeout Submittals:
  - .1 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

### **1.3 DELIVERY, STORAGE, AND HANDLING**

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

### **1.4 AMBIENT CONDITIONS**

- .1 Maintain air temperature and structural base temperature at flooring installation area above 20°C for 48 hours before, during, and 48 hours after installation.

### **1.5 MAINTENANCE**

- .1 Extra Materials:
  - .1 Provide extra materials of resilient sheet flooring and adhesives in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Provide 5 m<sup>2</sup> of each resilient flooring material required for project, for maintenance use.
  - .3 Provide 5 m of of rubber base material required for project, for maintenance use.
  - .4 Extra sheet materials to be one piece and from same production run as installed materials.
  - .5 Identify each roll of sheet flooring and each type of tile.
  - .6 Deliver to Departmental Representative, upon completion of the work of this section.
  - .7 Store where directed by Departmental Representative.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Sheet vinyl: To ASTM F1913, homogeneous single-layered vinyl sheet, polyurethane finish, heat-weldable for use in medical environments.
  - .1 Wear layer/Overall thickness to ASTM F386: 2.0 mm.
  - .2 Static load limit - ASTM F970: To exceed.
  - .3 Residual indentation to ASTM F1914: To exceed.
  - .4 Chemical resistance to ASTM F925: Meet or exceed.



- .5 Flame spread to CAN/ULC S102.2: 100.
- .6 Smoke evolved to CAN/ULC S102.2: 280.
- .7 Pattern and colour: Marbled, speckled texture with medium colour variance.
  - .1 Confirm selection with Departmental Representative.
  - .2 Supply colour-coordinated weld rod for heat-welding seams.
- .2 Luxury vinyl tile: To ASTM F1066, homogeneous single-layered vinyl tiles.
  - .1 Wear layer: 0.56 mm (22 mil).
  - .2 Overall thickness: 5 mm.
  - .3 Pattern: Embossed.
  - .4 Static load limit to ASTM F970: 1500 psi.
  - .5 Slip resistance to ASTM C1028: Minimum 0.6.
  - .6 Tile dimensions: 300 x 600 mm (12 x 24 inches).
  - .7 Installation layout: Ashlar pattern.
  - .8 Colour and pattern: Linear, grasscloth look with minimal tonal variation.
    - .1 Confirm selection with Departmental Representative.
- .3 Resilient base (RB): To ASTM F1861, continuous, top set, complete with premoulded end stops and external corners:
  - .1 Type: Rubber.
  - .2 Thickness: 3.2 mm.
  - .3 Height: 102 mm.
  - .4 Lengths: Cut lengths minimum 2400 mm.
  - .5 Profile: Toeless.
  - .6 Colour: As selected by Departmental Representative.
- .4 Cove filler strip: PVC with additives and colourants, 32 mm (1-1/4 inch) radius.
- .5 Cove cap moulding: Extruded aluminum, sized for coved sheet material.
- .6 Transition strips: Purpose-made extruded clear satin anodized aluminum edge strips; height as required to suit installation and provide smooth transition between floor finish transitions; with integral perforated anchoring leg for setting strip into setting material. Provide strips for transitions:
  - .1 Carpet to luxury vinyl tile.
  - .2 Carpet to sheet vinyl.
- .7 Primers and adhesives: Types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.
  - .1 Rubber floor adhesives:
  - .2 Base adhesives:
- .8 Sub-floor filler and leveller: Self-levelling cementitious compound capable of bonding to properly prepared substrate surfaces.
  - .1 Compressive strength: Minimum 36.5 MPa (5300 psi) at 28 days.

- .2 Capable of being walked on without damage after 3 hours.
- .3 Capable of being coated after 24 hours at 21°C.

### **Part 3 Execution**

#### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

#### **3.2 EXAMINATION**

- .1 Verify conditions of substrates are acceptable for product installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.
- .3 Confirm flatness of substrate by measurements taken in accordance with ASTM E1155/E1155M.
  - .1 Composite flatness ( $F_F$ ): Minimum 36.
  - .2 Composite levelness ( $F_L$ ): Minimum 20.

#### **3.3 PREPARATION**

- .1 Remove existing resilient flooring.
- .2 Remove or treat old adhesives to prevent residual, old flooring adhesives from bleeding through to new flooring and/or interfering with the bonding of new adhesives.
- .3 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.
- .4 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .5 Prime and seal concrete slab to resilient flooring manufacturer's printed instructions.

#### **3.4 APPLICATION: FLOORING**

- .1 Provide high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours after installation. If possible, vent directly to outside. Do not let contaminated air recirculate through district or whole building air distribution system. Maintain extra ventilation for at least one month following building occupation.

- .2 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .3 Lay flooring with seams parallel to building lines to produce a minimum number of seams. Border widths: minimum 1/3 width of full material.
- .4 Double cut sheet joints and heat weld according to manufacturer's printed instructions.
- .5 As installation progresses, and after installation, roll flooring with 45 kg minimum three-section roller to ensure full adhesion.
- .6 Cut flooring around fixed objects.
- .7 Continue flooring over areas that will be under built-in furniture.
- .8 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.
- .9 Install metal edge strips at unprotected or exposed edges where flooring terminates.
- .10 Coved base: Turn up flooring to form base. Back floor and wall junction with cove filler strip. Adhere cap strip to terminate base.
  - .1 Install coved base top cap level and straight.
  - .2 Inside corners: Cut away excess material to achieve net fit, and heat weld seam formed from cutting.
  - .3 Outside corners: Form corner with a butterfly piece, heat welded into place.

### **3.5 APPLICATION: BASE**

- .1 Lay out base to keep number of joints at minimum.
- .2 Clean substrate and prime with one coat of adhesive.
- .3 Apply adhesive to back of base.
- .4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.
- .5 Install straight and level to variation of 1:1000.
- .6 Scribe and fit to door frames and other obstructions. Use pre-moulded end pieces at flush door frames.
- .7 Cope internal corners. Use pre-moulded corner units for right angle external corners. Use formed straight base material for external corners of other angles.
- .8 Heat weld base in accordance with manufacturer's printed instructions.

### **3.6 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management and Disposal: Remove waste material in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3 Remove excess adhesive from floor, base and wall surfaces without damage.

**3.7 PROTECTION**

- .1 Protect new floors from time of final set of adhesive until final inspection.
- .2 Prohibit traffic on floor for 48 hours after installation.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Association of Textile Chemists and Colorists (AATCC)
  - .1 AATCC Test Method 134-2011, Electrostatic Propensity of Carpets.
  - .2 AATCC 175-08, Stain Resistance: Pile Floor Carpetings.
- .2 ASTM International
  - .1 ASTM D1335-12, Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings.
  - .2 ASTM E662-12, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
  - .3 ASTM E1155/E1155M-14, Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers.
  - .4 ASTM F2170-11, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- .3 Canadian Standards Association (CSA)
  - .1 CSA B651-12, Accessible Design for the Built Environment.
- .4 Carpet and Rug Institute (CRI)
  - .1 CRI Carpet Installation Standard 2011.
  - .2 CRI Green Label Plus Indoor Air Quality Testing Program.
- .5 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC S102.2-07, Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

**1.2 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for each carpet tile, adhesive, and sub-floor patching compound. Include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2 Submit 2 copies of WHMIS MSDS, include VOC content.
- .3 Shop Drawings:
  - .1 Information on shop drawings to indicate:
    - .1 Tile installation orientation.
- .4 Samples:
  - .1 Submit for review and acceptance of each unit.

- .2 Submit duplicate full-sized samples of each type of carpet tile specified and duplicate tiles for each colour selected.
- .5 Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .6 Test and Evaluation Reports:
  - .1 Certified test reports showing compliance with specified performance characteristics and physical properties.
- .7 Manufacturer's Instructions: Submit manufacturer's installation and storage instructions.
- .8 Qualification Statements:
  - .1 Compliance: To CAN/ULC-S102.2.
  - .2 Testing: Passes testing requirements of:
    - .1 Green Label Plus Indoor Air Quality Testing Program.
  - .3 Tuft bind: meets requirements of CAN/CGSB 4.129 when tested to CAN/CGSB 4.2 No.77.1.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: Submit operation and maintenance data for installed products for incorporation into manual.

### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra stock materials: Deliver extra materials to Departmental Representative, from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.
  - .1 Quantity: Provide minimum of:
    - .1 Carpet tile: Full sized tiles equal to 5% of amount installed.

### **1.5 QUALITY ASSURANCE**

- .1 Use material from same dye lot.

### **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
- .3 Store and protect carpet tile and adhesive in original containers or wrapping with manufacturer's seals and labels intact.
- .4 Store and protect carpet tile and accessories in location as directed by Departmental Representative.
- .5 Store carpet at minimum temperature of 18°C and relative humidity of maximum 65% for minimum 48 hours before installation.
- .6 Prevent damage to materials during handling and storage. Keep materials under cover and free from dampness.
- .7 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .8 Replace defective or damaged materials with new.

## **1.7 SITE CONDITIONS**

- .1 Moisture: Ensure substrate is within moisture limits and alkalinity limits recommended by manufacturer. Prepare moisture testing and provide report to Departmental Representative.
- .2 Temperature: Maintain ambient temperature of not less than 18°C from 48 hours before installation to at least 48 hours after completion of work.
- .3 Relative humidity: Maintain between 10% and 65% for 48 hours before, during and 48 hours after installation.
- .4 Install carpet after space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete.

## **Part 2 Products**

### **2.1 CARPET TILE**

- .1 CPT1: Typical performance:
  - .1 Pile Surface Appearance: Patterned loop.
  - .2 Pile fibre: Nylon.
  - .3 Dyeing method: 100% solution dyed.
  - .4 Backing: Non-woven synthetic fibre.
  - .5 Face weight: 712 g/m<sup>2</sup>.
  - .6 Machine gauge: 50.4 rows/10 cm.
  - .7 Stitch count: 39.4 stitches/10 cm.
  - .8 Pile height: 4.7 mm average.
  - .9 Size: 450 x 900 mm (18 x 36 inches).
  - .10 Static propensity: Maximum 1.2 kV to AATCC 134.
  - .11 Air quality: To CCI/CRI Green Label Plus requirements.
  - .12 Colour and pattern: Linear, grey/beige/black.

- .1 Confirm selection with Departmental Representative.
- .13 Installation layout: Ashlar.

## **2.2 ACCESSORIES**

- .1 Adhesive:
  - .1 Adhesive film tabs: Polyethylene film tabs with pressure sensitive adhesive, as recommended by carpet manufacturer.
- .2 Transition Mouldings:
  - .1 Carpet edge / reducer strip: Extruded aluminum, purpose made strip; profile to provide smooth transition, to protect carpet edge; height to comply with accessibility requirements of CSA B651.
    - .1 Maximum height: 13 mm.
    - .2 For transition mouldings greater than 6 mm high, provide transition mouldings bevelled at maximum slope of 1:2 (50%).
- .3 Sub-floor filler and leveller: Self-levelling cementitious compound capable of bonding to properly prepared substrate surfaces.
  - .1 Compressive strength: Minimum 36.5 MPa (5300 psi) at 28 days.
  - .2 Capable of being walked on without damage after 3 hours.
  - .3 Capable of being coated after 24 hours at 21°C.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verify conditions of substrates are acceptable for carpet tile installation in accordance with adhesive manufacturer's written instructions.
  - .1 Inform Departmental Representative of unacceptable conditions.
  - .2 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Confirm flatness of substrate by measurements taken in accordance with ASTM E1155/E1155M.
  - .1 Composite flatness ( $F_F$ ): Minimum 25.
  - .2 Composite levelness ( $F_L$ ): Minimum 20.

### **3.2 PREPARATION**

- .1 Subfloor Preparation:
  - .1 Inspect concrete and determine special care required to make it a suitable for carpet.
  - .2 Fill and level cracks 3 mm wide or protrusions over 0.8 mm with appropriate and compatible patching compound.
  - .3 Comply with manufacturer's written recommendations for maximum patch thickness.



- .4 Prime large patch areas with compatible primer.
- .5 Ensure concrete substrates are clean and dry.
- .6 Ensure concrete substrates are free of paint, dirt, grease, oil, curing or parting agents, and other contaminants, including sealers, that interfere with the bonding of adhesive.
- .7 Where powdery or porous concrete surface is encountered, apply primer compatible with adhesive to provide a suitable surface for glue-down installation.
- .2 Surface Preparation: Prepare surface in accordance with manufacturer's written recommendations and co-ordinate with Section 01 71 00 - Examination and Preparation.
  - .1 Prepare floor surfaces in accordance with CRI Carpet Installation Standard.

### **3.3 INSTALLATION**

- .1 Install carpet tiles in accordance with manufacturer's written instructions, and CRI Carpet Installation Standard; co-ordinate with Section 01 73 00 - Execution.
- .2 Co-ordinate tile carpeting work with work of other trades, for proper time and sequence to avoid construction delays.
- .3 Install carpet tile after finishing work is completed.
- .4 Snugly join carpet tiles in completed installation.
  - .1 Do not trap yarn between carpet tiles.
- .5 Ensure finished installation presents smooth wearing surface free from conspicuous seams, burring and other faults.
- .6 Scribe tiles around architectural, mechanical, electrical, and telephone outlets, and furniture fitments, around perimeter of rooms into recesses, and around projections.
- .7 Extend carpet tiles into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- .8 Install carpet tiles smooth and free from bubbles, puckers, and other defects.
- .9 Protect exposed carpet tile edges at transition to other flooring materials with suitable transition strips.

### **3.4 CLEANING**

- .1 Progress Cleaning: Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
  - .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
    - .1 Vacuum carpets clean immediately after completion of installation, using commercial machine with face-beater element.
- .2 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**3.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Install carpet protection to satisfaction of Departmental Representative.
- .3 Repair damage to adjacent materials caused by tile carpeting installation.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM D5420-10, Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
  - .2 ASTM E84-12, Surface Burning Characteristics of Building Materials.
- .2 Gypsum Association (GA)
  - .1 GA-214-15, Recommended Levels of Finish for Gypsum Board, Glass Mat, and Fiber-Reinforced Gypsum Panels.
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC S102.2-07, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

**1.2 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data:
  - .1 Submit manufacturer's current printed product literature, including specifications and installation instructions.
- .3 Samples:
  - .1 Submit duplicate manufacturer samples of wall coverings, in proposed colours and finishes.
  - .2 Due to product lead times, order material immediately upon acceptance of wall covering by Departmental Representative.
- .4 Test reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
- .5 Closeout Submittals:
  - .1 Provide maintenance data for wall covering in accordance with Section 01 78 00 - Closeout Submittals.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Store panels on level, flat surface, off the ground, in dry area.
- .3 Leave protective film on panels until installation.
- .4 Waste Management and Disposal:

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

#### **1.4 AMBIENT CONDITIONS**

- .1 Temperature: Maintain air temperature and structural base temperature at wall covering installation area above 20°C and relative humidity below 40% for 72 hours before, during, and 72 hours after installation.
- .2 Ventilate area of work as directed by Departmental Representative.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Hygienic wall covering: 100% pure vinyl, extruded rigid PVCu sheet; homogeneous composition.
  - .1 Thickness: 2.5 mm.
  - .2 Complies with CAN/ULC S102.2, Class A.
  - .3 Impact resistance to ASTM D5420: Minimum 18 N-m (160 inch-pounds).
  - .4 Texture: Smooth.
  - .5 Colour: White.
- .2 Sealer: As recommended by wall covering manufacturer.
- .3 Adhesive: Water-based acrylic adhesive, as recommended by wall covering manufacturer.

### **Part 3 Execution**

#### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

#### **3.2 EXAMINATION**

- .1 Verify conditions of substrates are acceptable for dry erase wall covering installation in accordance with manufacturer's instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Substrate: Level 4 finish to GA-214.
- .3 Verify substrate is flat, clean, dry, smooth, structurally sound, and free from surface imperfections that may telegraph through finished surface.

- .4 Test substrate with moisture meter; ensure moisture content is not greater than 4%.

### **3.3 PREPARATION**

- .1 Pre-condition wall covering minimum 24 hours in area of installation before application. Store covering flat and free of distortion.
- .2 Ensure area of installation is dust-free.
- .3 Ensure work that penetrates substrate is completed before installation of covering.
- .4 Prepare surfaces according to wall covering manufacturer's instructions.

### **3.4 INSTALLATION**

- .1 Prime and seal substrate as recommended by sheet manufacturer, minimum 12 hours prior to installation of wall covering.
- .2 Cut cleanly and finish sheet with straight, smooth sanded edges.
- .3 Apply adhesive to substrate as recommended by manufacturer.
- .4 Install wall covering straight, level, and plumb.
- .5 Remove excess adhesive along finished seams immediately after strips of wall covering are applied.
- .6 Clean entire wall covering surface with warm, mild soap solution.
- .7 Use clean warm water for final rinsing of wall covering.

### **3.5 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Clean surfaces to covering manufacturer's written instructions.

### **3.6 PROTECTION**

- .1 Protect finished surfaces and trim from damage until final inspection.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM C423-09a, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
  - .2 ASTM C665-12, Mineral-Fibre Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - .3 ASTM E90-04, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  - .4 ASTM E413-04, Classification for Rating Sound Insulation.
- .2 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC S102-03, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC S102.2-07, Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
  - .3 CAN/ULC S114-05, Test for Determination of Non-Combustibility in Building Materials.
  - .4 CAN/ULC S702-09, Standard for Mineral Fibre Thermal Insulation for Buildings.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.2 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheets.
  - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC content of insulation products.
- .3 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.
- .4 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver materials in manufacturer's original containers clearly labeled with manufacturer's name, product identification, safety information, net weight of contents and expiration date.

## **1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate facilities.

## **1.5 PROJECT CONDITIONS**

- .1 Maintain environmental conditions of temperature, humidity, and ventilation within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.
- .2 Ventilate area to receive insulation to maintain safe working conditions.
- .3 Protect workers as recommended by standards and manufacturer's recommendations.

## **Part 2 Products**

### **2.1 BATT INSULATION**

- .1 Acoustic batt insulation: To CAN/ULC S702, Type 1; non-combustible to CAN/ULC S114, lightweight, semi-rigid stone wool batt insulation.
  - .1 Surface burning characteristics to CAN/ULC S102:
    - .1 Flame spread: 0.
    - .2 Smoke developed: 0.
  - .2 Airborne sound transmission loss: To ASTM E90.
  - .3 Rating sound insulation: To ASTM E413.
  - .4 Sound absorption coefficients: To ASTM C423:

Thickness (mm)	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	NRC
25	0.14	0.25	0.65	0.90	1.01	1.01	0.70
38	0.18	0.44	0.94	1.04	1.02	1.03	0.85
50	0.28	0.60	1.09	1.09	1.05	1.07	0.95
76	0.52	0.96	1.18	1.07	1.05	1.05	1.05
102	0.86	1.11	1.20	1.07	1.08	1.07	1.10

### **2.2 BLANKET INSULATION**

- .1 Acoustic blanket insulation: To ASTM C665, glass fibre blanket insulation with glass fibre mat surface on one side.
  - .1 Surface burning characteristics to CAN/ULC S102.2:
    - .1 Flame spread: 25 or less.
    - .2 Smoke developed: 50 or less.
  - .2 Colour: Black.

.3 Sound absorption coefficients: To ASTM C423:

Thickness (mm)	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	NRC
25	0.10	0.34	0.65	0.87	0.91	0.91	0.70
50	0.27	0.80	1.12	1.07	1.02	1.01	1.00

### **Part 3 Execution**

#### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

#### **3.2 GENERAL**

- .1 Install insulation after building substrate materials are dry.
- .2 Install insulation to maintain continuity of sound absorption between partitioned spaces.
- .3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around doors and windows and other protrusions.
- .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures.
- .5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- .6 Offset both vertical and horizontal joints in multiple layer applications.
- .7 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

#### **3.3 EXAMINATION**

- .1 Examine substrates and immediately inform Departmental Representative in writing of defects.
- .2 Verify substrates are firm, straight, smooth, dry, and clean of dust and debris.
- .3 Verify acoustic and firestop sealants required at stud framing junctions with adjacent building components or at mechanical and electrical conduit and duct penetrations are installed.
- .4 Confirm mechanical, electrical, and telecommunications service lines in walls and ceilings to be insulated have been inspected.

#### **3.4 BATT INSULATION INSTALLATION**

- .1 Install acoustic insulation where indicated to maintain sound attenuation of separation in building elements and spaces.



- .2 Place acoustic blankets between studs ensuring friction fit, free of sags, folds, voids, or open joints that may let sound pass through.
- .3 Do not compress insulation excessively to fit voids.
- .4 Fit insulation closely around electrical boxes, pipes, ducts, frames, and other objects in or passing through insulation.

### **3.5 BLANKET INSULATION INSTALLATION**

- .1 Loose-lay blanket insulation above acoustic ceiling tile, install two layers.
- .2 Lay insulation to obtain tight joints between blankets.
- .3 Lap seams between blanket layers minimum 300 mm.

### **3.6 CLEANING**

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .2 Repair damage to adjacent materials caused by insulation installation.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .2 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .3 Master Painters Institute (MPI)
  - .1 MPI Architectural Painting Specifications Manual, current edition.
  - .2 MPI Maintenance Repainting Manual, current edition.
- .4 National Fire Code of Canada - 2010.
- .5 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

**1.2 QUALITY ASSURANCE**

- .1 Pre-Installation Meeting:
  - .1 Convene pre-installation meeting one week prior to beginning work of this Section in accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart.
    - .1 Verify project requirements.
    - .2 Review installation and substrate conditions.
    - .3 Coordination with other building sub-trades.
    - .4 Review installation instructions and warranty requirements.

**1.3 SCHEDULING**

- .1 Submit work schedule for various stages of painting to Departmental Representative for review. Submit schedule minimum of 48 hours in advance of proposed operations.
- .2 Obtain written authorization from Departmental Representative for changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants.

**1.4 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit product data and instructions for each paint and coating product to be used.
  - .2 Submit product data for the use and application of paint thinner.

- .3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS). Indicate VOCs during application and curing.
- .3 Samples:
  - .1 Submit full range colour sample chips to indicate where colour availability is restricted.
  - .2 Submit duplicate 200 x 300 mm sample panels of each paint and stain with specified paint or coating in colours, gloss/sheen, and textures required, to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:
    - .1 3 mm plate steel for finishes over metal surfaces.
    - .2 100 mm hardboard for finishes over wood surfaces.
    - .3 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.
  - .3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.
  - .4 Certificates: Submit certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.
  - .5 Manufacturer's Instructions:
    - .1 Submit manufacturer's application instructions.
  - .6 Closeout Submittals: Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:
    - .1 Product name, type, and use.
    - .2 Manufacturer's product number.
    - .3 Colour numbers.

## **1.5 MAINTENANCE**

- .1 Extra Materials:
  - .1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.
  - .2 Quantity: Provide one 4 litre can of each type and colour of primer, stain, and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Pack, ship, handle, and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Identify products and materials with labels indicating:
  - .1 Manufacturer's name and address.
  - .2 Type of paint or coating.

- .3 Compliance with applicable standard.
- .4 Colour number in accordance with established colour schedule.
- .3 Remove damaged, opened, and rejected materials from site.
- .4 Storage and Protection:
  - .1 Provide and maintain dry, temperature controlled, secure storage.
  - .2 Store materials and supplies away from heat generating devices.
  - .3 Store materials and equipment in well-ventilated area with temperature range 7°C to 30°C.
- .5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.
- .7 Remove paint materials from storage only in quantities required for same day use.
- .8 Fire Safety Requirements:
  - .1 Provide one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
  - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
  - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.
- .9 Waste Management and Disposal:
  - .1 Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
  - .3 Place materials defined as hazardous or toxic in designated containers.
  - .4 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional, and Municipal regulations.
  - .5 Ensure emptied containers are sealed and stored safely.
  - .6 Dispose of unused paint and coating materials at official hazardous material collections site.
  - .7 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
  - .8 Material that cannot be reused is to be treated as hazardous waste and disposed of in an appropriate manner.

- .9 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .10 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:
  - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
  - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
  - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
  - .4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.
  - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .11 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

## **1.7 SITE CONDITIONS**

- .1 Heating, Ventilation, and Lighting:
  - .1 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.
  - .2 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
  - .3 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity, and Substrate Moisture Content Levels:
  - .1 Unless pre-approved written approval by Specifying body and product manufacturer, perform no painting when:
    - .1 Ambient air and substrate temperatures are below 10°C.
    - .2 Substrate temperature is above 32°C unless paint is specifically formulated for application at high temperatures.
    - .3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.
    - .4 Relative humidity is under 85% or when the dew point is more than 3°C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3°C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.
    - .5 Ensure conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.

- .2 Perform painting work when maximum moisture content of the substrate is below:
  - .1 12% for plaster and gypsum board.
  - .2 15% for wood.
- .3 Test for moisture using calibrated electronic Moisture Meter.
- .4 Test plaster surfaces for alkalinity as required.
- .3 Surface and Environmental Conditions:
  - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
  - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
  - .3 Apply paint when previous coat of paint is dry or adequately cured.
- .4 Additional interior application requirements:
  - .1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Provide paint materials for paint systems from single manufacturer.
- .3 Conform to latest MPI requirements for interior painting work including preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.
- .5 Linseed oil, shellac, and turpentine: Highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.
- .6 Use MPI listed materials having minimum E2 rating where indoor air quality (odour) requirements exist.
- .7 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:
  - .1 Manufactured without compounds that contribute to ozone depletion in the upper atmosphere.
  - .2 Manufactured without compounds that contribute to smog in the lower atmosphere.
  - .3 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.

- .8 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .9 Flash point: 61.0°C or greater for water-borne surface coatings and recycled water-borne surface coatings.
- .10 Water-borne paints and stains, recycled water-borne surface coatings, and water borne varnishes to meet minimum "Environmentally Friendly" rating.

## **2.2 COLOURS**

- .1 Selection of colours from manufacturers' full range of colours.
- .2 Where specific products are available in restricted range of colours, selection based on limited range.
- .3 Second coat in three-coat system to be tinted slightly lighter colour than topcoat to show visible difference between coats.

## **2.3 MIXING AND TINTING**

- .1 Perform colour tinting operations prior to delivery of paint to site. Obtain written approval from Departmental Representative for tinting of painting materials.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.
- .4 Thin paint for spraying in accordance with paint manufacturer's instructions.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

## **2.4 GLOSS/SHEEN RATINGS**

- .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 2 - Velvet-Like Finish	Max. 10	10 to 35
Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 35
Gloss Level 5 - Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

- .2 Gloss level ratings of painted surfaces as noted on Finish Schedule.

## **2.5 INTERIOR PAINTING SYSTEMS**

- .1 Galvanized metal: Metal doors, frames:
- .1 INT 5.3M – High performance architectural latex, G5 finish.
- .2 Gypsum wallboard:
- .1 INT 9.2B - High performance architectural latex.
    - .1 Walls: G4 finish.
- .3 Wood doors:
- .1 INT 6.3Q – Waterborne varnish, G4 finish.

## **2.6 INTERIOR REPAINTING**

- .1 Galvanized metal: High contact/high traffic areas (doors, frames).
- .1 RIN 5.3J – High performance architectural latex, G5 finish.
- .2 Gypsum wallboard:
- .1 RIN 9.2B – High performance architectural latex.
    - .1 Walls: G4 finish.
- .3 Steel – high heat: Radiators.
- .1 RIN 5.2A – Heat resistant enamel (maximum 205°C).

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage, and installation instructions, and data sheet.



**3.2 GENERAL**

- .1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

**3.3 EXAMINATION**

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
  - .1 Plaster and gypsum board: 12%.

**3.4 PREPARATION**

- .1 Protection:
  - .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative.
  - .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
  - .3 Protect factory finished products and equipment.
  - .4 Protect, building occupants and general public in and about the building.
- .2 Surface Preparation:
  - .1 Remove electrical cover plates, light fixtures, surface hardware on doors, surface mounted equipment, fittings, and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
  - .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
  - .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative.
- .3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
  - .1 Remove dust, dirt, and other surface debris by vacuuming, and wiping with dry, clean cloths.

- .2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
- .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
- .4 Allow surfaces to drain completely and allow to dry thoroughly.
- .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
- .6 Use trigger operated spray nozzles for water hoses.
- .7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.
- .4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.
- .5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
  - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
  - .2 Apply wood filler to nail holes and cracks.
  - .3 Tint filler to match stains for stained woodwork.
- .6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
- .7 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes and vacuum cleaning.
- .8 Touch up of shop primers with primer as specified.
- .9 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

### **3.5 APPLICATION**

- .1 Method of application to be as approved by Departmental Representative. Apply paint by brush and roller. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:
  - .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
  - .2 Work paint into cracks, crevices and corners.
  - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

- .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
- .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.
- .4 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .6 Sand and dust between coats to remove visible defects.
- .7 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
- .8 Finish top, bottom, edges and cut-outs of doors after fitting as specified for door surfaces.

### **3.6 SITE TOLERANCES**

- .1 Walls: No defects visible from a distance of 1000 mm at 90° to surface.
- .2 Ceilings: No defects visible from floor at 45° to surface when viewed using final lighting source.
- .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

### **3.7 RESTORATION**

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing, and handling of paint to clean condition as approved by Departmental Representative.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        ULC (Underwriters' Laboratories of Canada) - Fire Resistance Directory.
- .2        CAN/ULC-S102-10 - Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

**1.2                PERFORMANCE REQUIREMENTS**

- .1        Track: Support vertical test load of 23 kg (50 lbs) without visible deflection of track or damage to supports.
- .2        Track Size: Safely support moving loads.
- .3        Track and Mounting: Sufficiently rigid to resist visible deflection and without permanent set.

**1.3                SUBMITTALS**

- .1        Section 01 33 00: Submission procedures.
- .2        Product Data: Provide data for curtain fabric characteristics.
- .3        Shop Drawings: Indicate a reflected ceiling plan view of curtain track, hangers and suspension points, attachment details, schedule of curtain sizes.
- .4        Samples:
  - .1        Submit two (2) fabric samples, 150 mm (6 inches) in size, illustrating fabric colour and pattern.
  - .2        Submit 300 mm (12 inch) sample length of curtain track.
- .5        Installation Data: Manufacturer's special installation requirements including special procedures, perimeter conditions requiring special attention.

**1.4                CLOSEOUT SUBMITTALS**

- .1        Section 01 78 00: Submission procedures.
- .2        Operation and Maintenance Data: Include recommended cleaning methods and materials, and stain removal methods.

**1.5                DELIVERY, STORAGE, AND PROTECTION**

- .1        Section 01 61 00: Transport, handle, store, and protect products.

## **Part 2 Products**

### **2.1 TRACK MATERIALS**

- .1 Track: Extruded anodized aluminum sections.
  - .1 Aluminum: 6063-T6 alloy.
  - .2 Fastening: Flush to acoustic tile ceiling.
- .2 Track End Stops: Same material as track, mounted to ends of track.
- .3 Curtain Carriers: Nylon slider or roller to accurately fit track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal; self-lubricating; one (1) carrier for each 100 mm (6 inches) of fabric width.
  - .1 Provide re-usable breakaway carriers designed to disengage hook from axle at 5 kg (11 lbs) downward force.

### **2.2 CURTAIN MATERIALS**

- .1 Curtain: Nylon or polyester; opaque, anti-bacterial, flame-proofed to ULC; with grommets at 150 mm (6 inches) o.c.
  - .1 Length: Equal to floor-to-ceiling height minus 50 mm (2 inches) from finished ceiling at top and 390 mm (15 inches) above finished floor.
  - .2 Hems: Minimum 25 mm (1 inch) wide.
    - .1 Provide bottom hem with weights.
  - .3 Grommets: Nickel-plated brass.
  - .4 Colour: As selected by Departmental Representative from manufacturer's full range.
- .2 Provide two full-sized curtains – one for immediate installation, and one spare.

### **2.3 FABRICATION**

- .1 Manufacture curtains in one piece, sized 10% wider than track length.
- .2 Curtain heading: Triple thickness 25 to 40 mm (1 to 1-1/2 inch) wide, with metal grommet holes for carriers spaced at 150 mm (6 inches) on centre, triple thickness bottom hem minimum 25 mm (1 inch) wide, including weights.

### **2.4 FINISHES**

- .1 Exposed Surfaces: Clear anodized finish.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verify conditions of substrates are acceptable for curtain track installation in accordance with manufacturer's instructions.

- .1 Visually inspect substrate.
- .2 Inform Departmental Representative of unacceptable conditions.
- .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Verify that field measurements are as indicated.
- .3 Verify that surfaces and above-ceiling supports are ready to receive work.

### **3.2 INSTALLATION**

- .1 Install curtain track to manufacturer's written instructions.
- .2 Install curtain track secure and rigid, true to ceiling line.
- .3 Install end caps.
- .4 Secure track to ceiling system.
- .5 Install curtain on carriers, ensuring smooth operation.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM A240-12, Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

**1.2 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for corner guards, Include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Installation Drawings: Indicate large scale details, materials, finishes, dimensions, anchorage and assembly.
- .4 Samples: Submit duplicate 150 mm long samples of profiles for corner and end wall guards.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect products from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Stainless steel: To ASTM A240, Type 304, brushed finish, minimum 1.5 mm thick, radiused profile.
- .2 Corner and end wall guards: 38 mm leg size, adhesive attached.
  - .1 CG-1: Corner guards.
  - .2 CG-2: End wall guards.

## **2.2 ACCESSORIES**

- .1 Adhesive: Low VOC, polyurethane-based; as recommended by manufacturer for substrate.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verify conditions of substrate are acceptable for corner and end wall guard installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 MANUFACTURER'S INSTRUCTIONS**

- .1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

### **3.3 INSTALLATION**

- .1 Install units on solid backing and erect with materials and components straight, tight, and in alignment.
- .2 Surface mount corner and end wall guards to substrate with adhesive.
- .3 Install to heights as shown in Drawings.

### **3.4 CLEANING**

- .1 Progress Cleaning: Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .3 Clean surfaces after installation using manufacturer's written recommended cleaning procedures.
- .4 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .5 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **3.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by corner and end wall guard installation.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CSA B651-12, Accessible Design for the Built Environment.

**1.2 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and data sheets; include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect toilet and bathroom accessories from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Stainless steel sheet metal: No. 4 satin finish.
- .2 Fasteners: Concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit.

**2.2 COMPONENTS**

- .1 Towel dispenser: All welded construction, 0.79 mm (22 gauge) stainless steel, satin finish, smooth corners, free of sharp edges; rolled edge on dispenser opening.
  - .1 Mounting: Surface.
  - .2 Hinge: Concealed.
  - .3 Tumbler lock.
  - .4 Refill indicator.

- .5 Capacity for 200 C-fold or 350 multi-fold paper towels.
- .6 Typical dimensions: 275W x 200H x 100D mm (11W x 8H x 4D inches).
- .2 Soap dispenser: Surface mounted, manually operated, for use with commercially readily available refill cartridges.
  - .1 Material: Plastic.
  - .2 Lever: Push.
  - .3 Capacity: 1000 mL.
  - .4 Colour: White.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verify that conditions of substrates and surfaces to receive toilet and bathroom accessories are acceptable for product installation in accordance with manufacturer's instructions, prior to installation.
- .2 Inform Departmental Representative of unacceptable conditions.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

#### **3.2 INSTALLATION**

- .1 Install and secure accessories rigidly in place.
- .2 Install accessories level and plumb.

#### **3.3 CLEANING**

- .1 Progress Cleaning: Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

#### **3.4 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 National Fire Protection Association (NFPA)
  - .1 NFPA 10 - Portable Fire Extinguishers, 2013 Edition.
- .2 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC S503-05 (R2010) – Standard for Carbon Dioxide Fire Extinguishers.
  - .2 CAN/ULC S504-12 - Dry Chemical Fire Extinguishers.
  - .3 CAN/ULC S508-02 (R2013) - Rating and Fire Testing of Fire Extinguishers.

**1.2 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature and datasheet and include product characteristics, performance criteria, physical size, finish, and limitations.
- .3 Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, wall bracket mounted measurements, and location.
- .4 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.
- .5 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.
- .6 Closeout Submittals:
  - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.3 REGULATORY REQUIREMENTS**

- .1 Conform to National Building Code and NFPA 10 for requirements for extinguishers.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS**

- .1 Stored pressure type with large loop pull pin and shut-off nozzle, ULC labelled, and all metal valve assemblies.
  - .1 Size: 2.25 kg.
  - .2 Valve assemblies: All metal, with On/Off squeeze grip handles.
  - .3 Finish: High gloss polyester powder paint or baked enamel.
    - .1 Colour: Red.
  - .4 Allowable types:
    - .1 To CAN/ULC S503, CO<sub>2</sub> type.
      - .1 Carbon dioxide charged.
      - .2 Aluminum tank.
      - .3 Provide CO<sub>2</sub> type extinguishers where proximal to LAN Room and other contamination-sensitive areas.
    - .2 To CAN/ULC S504, ABC type, complete with pressure gauge.
      - .1 Ammonium phosphate powder charged.
      - .2 Drawn steel cylinder.
      - .3 Hose and nozzle.

### **2.2 ACCESSORIES**

- .1 Extinguisher Brackets: Formed steel with metal retainer strap, chromed finish.

### **2.3 IDENTIFICATION**

- .1 Identify extinguishers in accordance with recommendations of NFPA 10 and CAN/ULC S508.
- .2 Attach bilingual tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.
  - .1 Languages: English and French.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### **3.2 EXAMINATION**

- .1 Verify existing conditions before starting work.

**3.3            INSTALLATION**

- .1        Install or mount extinguishers on brackets as indicated, in accordance with NFPA 10 and manufacturer's instructions.
- .2        Secure rigidly in place to walls.
- .3        Position cabinet signage at locations acceptable to authority having jurisdiction.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 CAN/CSA C22.2 No. 60601-1:14, Medical Electrical Equipment – Part 1: General Requirements for Basic Safety and Essential Performance.

**1.2 PERFORMANCE REQUIREMENTS**

- .1 Table to be capable of supporting minimum load of 227 kg (500 lbs).

**1.3 SUBMITTALS**

- .1 Section 01 33 00: Submittal Procedures.
- .2 Product Data: Provide equipment dimensions and construction, equipment general load capacities, point loads, physical dimensions, utility and service requirements and locations.
- .3 Shop Drawings: Indicate equipment locations, large-scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, clearances required.
- .4 Manufacturer's Installation Instructions: Indicate special installation requirements.

**1.4 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 00: Submission procedures.
- .2 Provide manufacturer's written operating and maintenance instructions.

**1.5 REGULATORY REQUIREMENTS**

- .1 Conform to applicable code for equipment requirements and utility connections.
- .2 Conform to CSA requirements for safety and performance of operating equipment.

**Part 2 Products**

**2.1 FABRICATION**

- .1 Fabricate manual examination table with:
  - .1 Shell: 1.21 mm (18 gauge) thick steel.
  - .2 Upholstered top; manually adjustable back section; 0 – 70° back section adjustment; steel reinforcement.
    - .1 Dimensions: Approximately 760 x 1430 mm (30 x 56 inches).

- .3 Extendable footrest shelf with seamless upholstered pad and removable treatment pan; 250 mm (10 inch) extension.
- .4 Right and left stirrups: 400 mm (16 inch) extension, 4 lateral positions.
- .5 Storage drawers: Polystyrene, seamless construction; ball bearing slides.
  - .1 3 side drawers.
  - .2 2 front drawers.
- .6 4 levelling feet.
- .7 Paper roll holder: For 530 mm (21 inch) wide roll.
- .2 Electrical requirements: To CAN/CSA C22.2 No. 60601-1; 115 VAC, 50/60Hz, 5.0 amps, with receptacle.

**2.2 FINISHES**

- .1 Metal surfaces: Powder coat paint.

**Part 3 Execution****3.1 EXAMINATION**

- .1 Verify conditions of substrates are acceptable for product installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

**3.2 INSTALLATION**

- .1 Install equipment required by this section, in accordance with manufacturer's written instructions.
- .2 Install table plumb and level, accurately fitted, free from distortion and defects.
- .3 Sequence installation to ensure utility connections are achieved in a neat, orderly and expeditious manner. Confirm utilities are connected and ready for use.
- .4 Touch-up minor damaged surfaces caused during installation.
- .5 Replace damaged components as directed by Departmental Representative.

**3.3 ADJUSTING**

- .1 Adjust equipment for smooth operation.

**3.4 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.

- .2 Waste Management and Disposal: Remove waste material in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**END OF SECTION**



**Part 1 General**

**1.1 SYSTEM DESCRIPTION**

- .1 Horizontal slat louvre blinds installed at window openings; manual control of raising and lowering by cord for full range locking; blade angle adjustable by control wand.

**1.2 SUBMITTALS**

- .1 Section 01 33 00: Submittal Procedures.
- .2 Product Data: Provide manufacturer's data sheets indicating physical and dimensional characteristics, operating features.
- .3 Shop Drawings: Indicate opening sizes, method of attachment, clearances, and operation.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Vinyl Slats: 25 mm (1 inch) wide; PVC, horizontal slats, radiused slat corners.
  - .1 Colour: As selected by Departmental Representative.
- .2 Slat Support: Woven polypropylene, ladder configuration.
- .3 Head Rail: Pre-finished, formed aluminum box; internally fitted with hardware, pulleys, and bearings for operation.
- .4 Control Wand: Extruded hollow plastic removable type; length of window opening height.
- .5 Head Support Bracket Overhead head rail attachment.
- .6 Accessory Hardware: Type recommended by blind manufacturer.

**2.2 FABRICATION**

- .1 Fabricate blinds to fit openings with uniform edge clearance of 7 mm (5/16) inch.

**2.3 FINISHES**

- .1 Colour: As selected by Departmental Representative.

**Part 3            Execution**

**3.1                EXAMINATION**

- .1        Section 01 70 00: Verify existing conditions before starting work.
- .2        Verify that field measurements are as indicated on shop drawings.
- .3        Verify that openings are ready to receive the work.

**3.2                INSTALLATION**

- .1        Install blinds to manufacturer instructions.
- .2        Secure in place with concealed fasteners.

**3.3                ADJUSTING**

- .1        Adjust blinds for smooth operation.

**END OF SECTION**

.1 General

**1.2 Regulatory Requirements**

- .1 Refer carefully to other parts of the specifications.
- .2 Conform to the requirements and recommendations of all local municipal, provincial and federal by-laws and ordinances.
- .3 Do not reduce the quality of work specified and/or shown on the drawings because of the Regulatory requirements.

**1.3 Applicable Codes And Standards**

- .1 In general and as applicable, the physical and chemical properties, the characteristics and the performance of items in this Division shall be as noted in the following:

- .1 Canadian Standards Association.
- .2 American National Standards Institute.
- .3 Provincial Building Code.
- .4 Civic Building By-Laws.
- .5 Civic Water Works By-Laws and Sewer By-Laws.
- .6 Provincial Fire Code.
- .7 Worker's Compensation Board Requirements.
- .8 American Society for Testing and Materials.
- .9 Canadian Government Specifications Board.
- .10 National Fire Protection Association.
- .11 Canadian Council of Ministers of the Environment Codes.
- .12 Underwriters' Laboratories of Canada.
- .13 Provincial Workplace Safety and Health Regulations.
- .14 Provincial Labour Regulations.
- .15 National Building Code of Canada.

**1.4 Latest Editions**

- .1 The latest edition of all codes and standards, of the date of tender submission, shall apply; except for specific editions referenced by overriding codes.

**1.5 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for specified equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province where work is taking place.
  - .2 Drawings to show:
    - .1 Mounting arrangements.

- .2 Operating and maintenance clearances.
- .3 Drawings and product data accompanied by:
  - .1 Detailed drawings of bases, supports, and anchor bolts.
  - .2 Acoustical sound power data, where applicable.
  - .3 Points of operation on performance curves.
  - .4 Manufacturer to certify current model production.
  - .5 Certification of compliance to applicable codes.
- .4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

## **1.6 Authorities Having Jurisdiction (Ahj)**

- .1 Comply with all requirements of Authorities with competent jurisdiction, including authorized inspectors, without additional compensation.

## **1.7 Permits, Fees And Certificates**

- .1 In addition to the requirements in Division 1, obtain all required Certificates of Inspection for the work and deliver same to the Departmental Representative before request for substantial performance. These include but are not limited to:
  - .1 Equipment start-up reports.
  - .2 Plumbing inspection certificate.
  - .3 Backflow prevention certificate.
- .2 Correct installed work as directed by the local Authorized Inspector of the Regulatory body without extra compensation.

## **1.8 Equipment List**

- .1 Compile a complete list of equipment and materials to be used on this project and forming part of tender documents by adding manufacturer's name, model number and details of materials.
- .2 Submit for review within ten (10) days after award of contract.

## **1.9 Specified Equipment Availability**

- .1 If specified equipment is not available (due to delays in delivery) at scheduled installation time an acceptable alternate shall be installed AT THE CONTRACTOR'S EXPENSE and replaced with the specified equipment when the specified equipment becomes available with no additional compensation.

## **1.10 Electrical Work**

- .1 Division 22 is responsible for the supply, physical installation, and operation of all electric motors, temperature and humidity controls systems, combustion controls systems, and other electrical devices and systems specified under its portion of the work. Bear full responsibility for factory installed wiring and equipment on packaged equipment, be responsible where detailed in equipment requirements for controlling devices such as, but not restricted to, pump and liquid level controls, multi-speed motor controllers, boiler controls, etc., which are necessarily integrally mounted on packaged equipment.

- .2 Submit detailed composite wiring diagrams for all control systems as specified and as required for the plumbing work for review by the Departmental Representative. Distribute copies of reviewed drawings to the Electrical Division for their reference.
- .3 Provide all wiring in approved rigid conduit to suit temperature and moisture conditions of area through which wire is to run. All wiring is in accordance with the relevant Electrical Codes, and in no case smaller than #12 AWG. Comply fully with the electrical specifications for all electrical work.

#### **1.11 Electrical Characteristics**

- .1 Check with the electrical trade and provide all mechanical items with correct electrical characteristics to suit the electrical work.
- .2 If correct characteristics are not available from the specified equipment manufacturer, contact the Departmental Representative prior to the close of tenders.
- .3 At time of ordering plumbing equipment, confirm electrical characteristics with the electrical contractor, and ensure that they have been confirmed with the power authority.
- .4 No additional compensation will be paid for problems arising from incorrect electrical characteristics.

#### **1.12 Cutting, Patching, Repairing, Making Good**

- .1 In addition to the requirements in Division 01, each trade requiring such work shall be responsible for necessary cutting. Patching by appropriate trade. All work to be performed by experienced tradesmen.
- .2 Neatly perform cutting and patching work to blend smoothly with surrounding surfaces.
- .3 Patch and make good disturbed surfaces to match existing adjacent work. Leave finished, neat, to Departmental Representative's approval.
- .4 Perform X-ray examination of wall and floors prior to making openings, where required to avoid damage to structural reinforcements and electrical conduits.

#### **1.13 Tests**

- .1 In addition to the requirements in Division 01, carry out all tests hereinafter noted, as required by the regulatory agencies and as requested by the Departmental Representative and furnish all labour and equipment required for such tests without extra compensation.
- .2 Before activating systems, review manufacturer's instructions, recheck equipment, check all connections, set all controls for proper start-up, obtain necessary clearances from the electrical division, etc.
- .3 Submit to the Departmental Representative, legible report for each test conducted, within one week of the test.
- .4 Notify the Departmental Representative and Owner at least two (2) working days ahead of all tests, so that the tests can be witnessed.

#### **1.14 Trial Usage**

- .1 Departmental Representative may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

### **1.15 Cleaning**

- .1 Refer to Section 01 74 11 – Cleaning.
- .2 Clean interior and exterior of all systems including strainers.

### **1.16 Functional Testing**

- .1 Test all plumbing equipment, fixtures and systems. Test as required by the AHJ and Departmental Representative, submitting comprehensive reports. Example forms are available from the Departmental Representative.
- .2 Ensure all tests demonstrate compliance with the specified and manufacturers' shop drawing and catalogued performance, as well as compliance with applicable standards.

### **1.17 Demonstration And Operating And Maintenance Instructions**

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Manufacturers, or expert suppliers, to provide demonstrations and instructions.
- .3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Where deemed necessary, Departmental Representative or Owner may record these demonstrations on videotape for future reference.
- .6 Submit training schedule and scope description to the Departmental Representative for review and approval for each training topic. Training shall not commence until approval of training schedule and scope if given by the Departmental Representative

### **1.18 Spare Parts**

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals and as follows:
  - .1 Six complete valves for each size type up to 38 mm, and one for each larger size and type.

### **1.19 Closeout Submittals**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
  - .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
  - .2 Operation data to include:
    - .1 Control schematics for systems including environmental controls.
    - .2 Description of systems and their controls.
    - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
    - .4 Operation instruction for systems and component.
    - .5 Description of actions to be taken in event of equipment failure.

- .6 Valves schedule and flow diagram.
- .7 Colour coding chart.
- .3 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .4 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
- .5 Approvals:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .6 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
  - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
  - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection.
- .8 As-Built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing, finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  - .3 Submit to Departmental Representative for approval and make corrections as directed.
  - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

- .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

#### **1.20 Maintenance Material Submittals**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

#### **1.21 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

#### **1.22 Waste Management**

- .1 Separate waste materials for reuse and recycling.
- .2 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

#### **1.23 Substantial Completion**

- .1 Provide minimum notice of ten (10) working days to the Departmental Representative prior to request to declare project Substantially Complete. Failure to do so may result in site review by Engineer being delayed. Show 2 weeks on construction schedule.
- .2 A minimum of three (3) working days before substantial completion is to be declared, submit the following:
  - .1 All certificates and documentation recommended by NFPA standards and required by these specifications and AHJ that are applicable to the project.
  - .2 Operation and Maintenance Manuals, complete with revisions as directed.
  - .3 Confirm all fire protection equipment is operational, under control, indicating exceptions and temporary controls/arrangements, including 'tenant' areas.
- .3 Confirm systems are ready for occupancy and use for intended purpose in every respect. Submit a letter signed by the manager or president of the prime contractor under Div 21 (i.e. the fire protection contractor) stating as such upon request of the Departmental Representative.
- .4 Before certification date submit detailed written confirmation of completion of deficient life safety work noted in the documentation listed in previous paragraphs, including date completed. Provide schedule for any outstanding or deferred non-life safety work that is to be completed.



## **1.24 Quality Of Materials**

- .1 Furnish new materials, apparatus or products required for the work, of first class quality, delivered, erected, connected up and finished in every detail.
- .2 The use of any or all materials is subject to the approval of the Departmental Representative.
- .3 Unless otherwise specified, all products shall be CSA approved.
- .4 All fire protection materials, apparatus or products shall be ULC approved.
- .5 If materials, apparatus or products are not CSA or ULC approved, obtain approval of the provincial regulatory authority. Pay all applicable charges levied and make all modifications required for approval.
- .6 Confirm colours with the Architect before ordering.

## **1.25 Safety Features**

- .1 Provide safety features on all equipment to ensure safe operation and maintenance including belt, coupling, and other guards, screened fan intakes and discharges where inadequate ductwork for protection, safety interlocks and labels.

## **Part 2 Products**

### **2.1 Motors**

- .1 Motors to be high efficiency, in accordance with local Hydro company standards and the requirements of ASHRAE 90.1.
- .2 Comply with all Canadian Electrical Code requirements, and in particular CSA C22.2 No. 100, c/w CSA label, unless otherwise specified.
- .3 Motors included in the scope of CAN/CSA-C747 shall have a nominal full-load efficiency not less than the minimum specified in that standard. Efficiency ratings of motors included in the scope of this standard shall be based on a statistically valid quality control procedure conforming to the standard. Nameplates shall list the nominal full-load motor efficiency.
- .4 Motors included in the scope of CAN/CSA-C390 shall have a nominal full-load efficiency not less than the minimum specified in that standard. Efficiency ratings of motors included in the scope of this standard shall be based on a statistically valid quality control procedure conforming to the standard. Nameplates shall list the nominal full-load motor efficiency.
- .5 In general, motors are EEMAC Class B (for standard torque applications), 1,800 RPM, continuous duty, open drip proof, ball bearing, 40°C temperature rise above 40°C ambient, 1.15 service factor. Motors are squirrel cage induction unless specifically noted otherwise. Special motors are specified with the equipment driven.
- .6 Single-phase motors shall be equipped with integral thermal overload protection.
- .7 Provide adequate capacity on each motor to operate the associated driven device under all conditions of load and service without overloading and be of at least the power specified.
- .8 Refer to Division 26 and provide motor characteristics within +5% of power source, or get written approval from the Departmental Representative.
- .9 Co-operate with Division 26 during start-up and provide all necessary assistance in commissioning.

- .10 If delivery of specified motor will delay delivery or installation of equipment, install motor approved by Departmental Representative for temporary use. Final acceptance of equipment will not occur until specified motor is installed.

## **2.2 Coupling For Direct Drive Equipment**

- .1 Couplings shall be sized such that it will endure an infinite number of starts when equipment is fully loaded. All couplings shall be covered with a removable safety guard.

## **2.3 Belt Drives**

- .1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.
- .2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.
- .3 For motors under 7.5 kW 10 HP: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.
- .4 For motors 7.5 kW 10 HP and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.
- .5 Correct size of sheave to be determined during commissioning.
- .6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .7 Motor slide rail adjustment plates to allow for centre line adjustment.
- .8 Supply one set of spare belts for each set installed.

## **2.4 Guards**

- .1 Provide guards for all drives as specified and required by Authorities Having Jurisdiction.
- .2 Guards for belt drives (minimum requirements):
- .1 Expanded galvanized metal screen welded to galvanized steel frame.
  - .2 Minimum 1.2 mm thick galvanized sheet metal tops and bottoms.
  - .3 Prime coat for painting.
  - .4 38 mm diameter holes on both shaft centres for insertion of tachometer.
  - .5 Allow movement of motors for adjusting belt tension.
- .3 Guards for flexible couplings (minimum requirements):
- .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
  - .2 Prime coat for painting.
- .4 Guards are to be readily removable to permit servicing of equipment.
- .5 Provide means to permit lubrication and use of test instruments with guards in place.
- .6 Ensure that all guards are securely fastened in place, sufficiently sturdy to provide the required safety and free of rattles and excess vibration.

## **2.5 Fire Separation Repair**

- .1 Refer to Section 07 84 00 – Firestopping.

- .2 Cooperate fully with other trades to ensure maintenance of the rating of fire separations that are penetrated, in strict compliance with the manufacturer's recommendations and requirements of the AHJ.

## **2.6 Accessibility**

- .1 Refer to Section 08 31 00– Access Panels.

- .1 Standard Type:

- .1 Door and Trim: 14 gauge steel. Trim 1-1/2 inches wide.
    - .2 Return Frame: 18 gauge steel. Depth 1-3/4 inches.
    - .3 Hinges: Fully-concealed. Opens 170 degrees. On long side of door. Number of hinges
    - .4 varies with size of door.
    - .5 Latches: Flush, stainless steel cam-operated with screwdriver. Positioned opposite hinge
    - .6 and at top and bottom on larger sizes.
    - .7 Finish: Electrostatically-applied, baked grey enamel coat over rust-inhibiting phosphate
    - .8 treated steel.
    - .9 Masonry Anchor Straps: Minimum of 4 straps per door, where required
    - .10 Cylinder Lock: Keyed alike with 2 keys per lock.
    - .11 Gaskets: Weather-resistant and air-tight neoprene gaskets.

- .2 Fire Rated Type:

- .1 UL Listed: rating to match assembly being installed in, 250 degrees C (450 degrees F) maximum temperature rise in 30 minutes for vertical wall installations.
    - .2 Frame: 16 gauge steel, 2 1/2 inches deep.
    - .3 Insulation: 2 inches thick mineral wool in between 2 pieces of 22 gauge steel.
    - .4 Hinge: Continuous piano hinge allows opening to 180 degrees. Hinge is on long side of door.
    - .5 Latches: Specially designed Ultra Lock-self-latching keyed cylinder paddle latch opposite hinge.
    - .6 Automatic panel closer on all doors. Vertical position only. Ceiling position has self-assisted closing.
    - .7 Inside panel release on all doors.
    - .8 rust-inhibiting phosphate treated steel. This coating can be used as a finish or as a prime coat.
    - .9 Finish: Electrostatically-applied, baked grey enamel coat over rust-inhibiting phosphate treated steel.
    - .10 Hot smoke seal gasketing for 4 sides.

- .2 Be responsible for supplying and locating all access panels in the ceiling, wall, partitions, etc., where openings are necessary for the inspection, servicing and/or removal of equipment, valves and other items that require periodic access. Panel type to suit the construction of the ceilings, walls, partitions, etc., in which they are located. Determine the

location subject to the approval of the Departmental Representative. Access panels to be installed by trade experienced in work with surface in which the panel is to be installed.

- .3 Mark mechanical access points in accessible ceilings with distinctive but inconspicuous tags properly attached to the ceiling grid. Obtain sample approval before purchase and installation. Indicate on record drawings.
- .4 Accessibility shall be defined as:
  - .1 Ability to place both hands on equipment or device, with no duct, pipe or other equipment in the way.
  - .2 Must be accessible while standing on maximum 2400 mm high stepladder.
  - .3 Must be in plain view.

## **2.7 Sleeves And Penetrations**

- .1 Install sleeves for all piping passing through floors and walls.
- .2 Sleeves as specifically noted, or through structural walls shall be Schedule 40 steel. All other sleeves are 6 mm galvanized sheet steel.
- .3 Fit sleeves flush on either side of the wall through which they pass, extend sleeves through floors and terminate 50 mm above finished floor. Adjust as necessary to accommodate the requirements of through-penetration fire-stopping systems.
- .4 Where passing through walls, make sleeves a minimum 6 mm clear of the piping, through floors make sleeves a minimum of 20 mm clear of the piping. Pack for full depth with fiberglass insulation & finish with a lagging compound. Penetrations through fire separations shall be repaired to maintain rating.
- .5 Provide escutcheon plates with set screws to completely cover openings for all exposed pipes passing through walls, subject to the approval of the Departmental Representative. Provide chrome plated plates in finished areas unless otherwise approved.
- .6 Be responsible for maintaining integrity of building envelope when making penetration to install equipment or devices. Enlist services of qualified trade to make openings in and/or repairs to building envelope.
- .7 Sleeving through steel beams shall be permitted only where approved by the Departmental Representative in writing or where expressly indicated on the Contract Documents. Sleeves are NOT permitted in concrete beams.
- .8 Seal all sleeves to make watertight

## **2.8 Counter Flashings**

- .1 In addition to the requirements in Division 01, provide watertight, non-corroding, counter flashings for all penetrations of the building envelope, painted to match adjacent materials after proper preparation and painting. Refer to drawings, including building drawings, for additional information.
- .2 Installation to allow for movement and accommodate high temperatures where necessary.
- .3 For short pipes, the flashing may overlap the end, in lieu of attachment to the pipe. Minimum 300 mm high above the roof, c/w water break above maximum water level on the roof, to negate wind effects.
- .4 All galvanized material to be 0.7 mm thick minimum.

- .5 In exposed locations, flashings must be aesthetically acceptable to the Departmental Representative.
- .6 Co-ordinate with all other trades including roofer and metal wall panel installer.
- .7 For copper pipe use 0.82 mm sheet copper, soldered to pipe end c/w solder joints.
- .8 For galvanized ducts use galvanized sheet metal soldered to the duct and c/w soldered joints.
- .9 For cast iron and steel pipes at normal temperature, use manufactured stretch fit heavy neoprene flashings c/w galvanized protective layer.
- .10 For hot pipes clamp galvanized to the pipe with a temperature rated gasket and stainless steel worm gear clamp.
- .11 For aluminum and stainless steel, use the same materials for the flashing.

### **Part 3 Execution**

#### **3.1 General**

- .1 All Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Do not scale the Drawings. Consult the Architectural Drawings and details for exact locations of fixtures and equipment; where some are not definitely located, obtain this information from the Departmental Representative.
- .2 Follow Drawings as closely as possible in laying out work and check Drawings of all other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. When headroom or space conditions appear inadequate, notify the Departmental Representative before proceeding with the installation.
- .3 Make reasonable modifications in the layout as needed without extra compensation to prevent conflicts with work of other trades or for proper execution of the work. This shall include, but not necessarily be confined to, offsets in piping or ducts, transformation in ductwork and relocation of ducts and piping up to 10 feet either way on each item as required to suit on site job conditions.
- .4 Where variances occur between the Drawings and Specifications or within either document itself, include in the contract, the item or arrangement of better quality, greater quantity, and higher cost or clarify before tenders close. The final decision on the item and manner in which work is installed rests with the Departmental Representative.
- .5 The mechanical contractor, with all trades involved shall provide marked-up drawings, when requested, of mechanical spaces indicating all dimensions for all installations prior to the work being done. Report any discrepancies to the Departmental Representative. Any conflicts arising that may have been resolved by laying the work out in this manner will be resolved WITHOUT ADDITIONAL COMPENSATION.
- .6 Provide 48 hours minimum notice to Departmental Representative and Owner of all work before it is concealed. Expose concealed work for inspection, upon request, when proper notice was not provided and pay all costs therefore, including making good other trades' work.

### **3.2 Surveys And Measurements**

- .1 Base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements shown on the Drawings at the site, and check the correctness of same as related to the work.
- .2 Notify the Departmental Representative if any discrepancy is discovered between the actual measurements and those indicated which prevent following good practice or the intent of the Drawings & Specifications. Do not proceed with the work until receiving instructions from the Departmental Representative.

### **3.3 Co-Ordination**

- .1 Give full co-operation to those doing work under other Divisions and furnish in writing with copies to the Departmental Representative any information necessary to permit the work of all Divisions to be installed satisfactorily and with least possible interference or delay. Work installed before full coordination is subject to removal and replacement without additional compensation.
- .2 Discuss work with other Divisions prior to installation. Confirm proposed locations for equipment installed by this Division will not interfere with work installed by others.
- .3 If work is installed before coordinating with other trades or so as to interfere with work of other trades, make necessary changes in the work to correct the conditions without extra compensation.
- .4 When requested, provide marked up drawings indicating required clearances for installation of plumbing equipment. Provide section drawings including location of other equipment not installed by Division 22, such as ducts, cable trays, other piping, etc. Report any discrepancies to the Departmental Representative.

### **3.4 Accessibility**

- .1 Locate all equipment that must be serviced, operated or maintained in fully accessible positions, with minimum interference and maximum usable space. Provide access doors as required to ensure sufficient access for service and inspection. Make minor modifications to routing and locations of equipment indicated on drawings as required to improve access to equipment. Obtain direction from the Departmental Representative where major modifications are necessary to provide sufficient access.

### **3.5 Scaffolding, Rigging, Hoisting**

- .1 Unless otherwise specified, furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment apparatus furnished. Remove same from the premises when no longer required.
- .2 Take precautions not to overload the structure in any manner nor provide inadequate scaffolding and rigging so as to endanger the safety of personnel on the site whether under this Division's employ or otherwise.

### **3.6 Cutting And Patching**

- .1 Cutting shall be performed neatly by this trade. No hammering or other methods are permitted without approval of the Departmental Representative and other trades affected. Utilize a rebar detector and stud finder to ensure cutting does not damage other elements.

- .2 Patching is to be done by the appropriate trade. Arrange and pay for all patching not specifically specified elsewhere in these specifications, including fire rated patching at fire separations.
- .3 Fill voids around pipes and ducts with fiberglass batt insulation and sheet metal closure strips. For fire separations, install fire stop material in accordance with manufacturer's details as required to meet the UL classification and to match separation rating. Ventilate adequately during curing. Provide adequate structural support in larger spaces. Install slightly above floors to provide positive drainage away from pipe or duct.
- .4 Provide a structural shop drawing stamped by a Professional Engineer showing all reinforcements required for openings through the structure. Allow for all costs of the reinforcement.

### **3.7 Supports**

- .1 Provide all necessary and recommended supports for all equipment furnished under this Division. Co-ordinate and facilitate all necessary and recommended foundations, pads, bases and piers provided under other Divisions for equipment furnished or installed under this Division.

### **3.8 Waterproofing**

- .1 Obtain approval for the installation method employed where any work pierces waterproofing concrete and waterproofing. Furnish all necessary grout rings sleeves, caulking, curbs, counter flashing and flashing required to make openings through roofs, walls, floors, etc., absolutely watertight. This applies to, but is not restricted to, roof exhausters, relief vents, penthouses, ducts, grilles, pipes, etc. Work involving the roofing is done in conjunction with the roofing Division. Work passing through roofing is to be done in accordance with applicable C.R.C.A. "FL" Series details.

### **3.9 Protection**

- .1 Protect the work and material of all other sections from damage and make good all damage thus caused, to the satisfaction of the Departmental Representative.
- .2 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

### **3.10 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Departmental Representative].

### **3.11 Painting Repairs And Restoration**

- .1 Do painting in accordance with Section 09 91 00 - Painting.
- .2 Prime and touch up marred finished paintwork to match original.

- .3 Restore to new condition, finishes which have been damaged.

### **3.12 System Cleaning**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

### **3.13 System Cleaning**

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

### **3.14 Field Quality Control**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report.
- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### **3.15 Demonstration**

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Departmental Representative will record these demonstrations on video tape for future reference.

### **3.16 Cleaning**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 – Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

### **3.17 Protection**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.



### **3.18 Equipment Start-Up**

- .1 Mechanical contractor shall ensure that all electrical/mechanical components match and that it is safe to start up plumbing equipment. See also Functional Testing.
- .2 All support such as electrical contractor, controls contractor, etc., shall be arranged by the mechanical and all trades directly involved in mechanical equipment being started shall be present for start up.

### **3.19 Manufacturers' Recommendations**

- .1 Install, adjust, test, start-up, and maintain all mechanical equipment in strict accordance with the manufacturer's recommendations. If in conflict with the drawings and specifications, contact the Departmental Representative for clarification. Include edited data in O&M manuals.
- .2 Ensure that the manufacturer recommends the product for its intended use. If in doubt, contact the Departmental Representative.

### **3.20 Personnel Protection**

- .1 In addition to the requirements in Division 01, provide visual warning signs and/or markers and mechanical protection devices for all mechanical items mounted below the minimum limits listed below and suspended more than 1500mm clear of the floor.
  - .1 Occupied spaces 2286 mm (7'-6").
  - .2 Service spaces 2133 mm (7'-0").
  - .3 Crawl spaces 1524 mm (5'-0").
- .2 Visual warning devices to be yellow tape with black stripes adhered to the entire perimeter of the item infringing on the occupied space. This will include but not be limited to:
  - .1 Length of pipes or equipment below specified height.
- .3 Mechanical protection devices to be 7 mm (1/4") wire mesh guard and/or 25 mm thick 'Armaflex' type insulation. This will include but not be limited to:
  - .1 Pipe and equipment hangers.
  - .2 Valves.

**END OF SECTION**

**Part 1            General**

**1.1            References**

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
  - .1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.
  - .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - .4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 ASTM International Inc.
  - .1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .2 ASTM A536, Standard Specification for Ductile Iron Castings.
  - .3 ASTM B88M, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
  - .1 ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International)
  - .1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
  - .1 MSS-SP-67, Butterfly Valves.
  - .2 MSS-SP-70, Gray Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS-SP-71, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
  - .4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
- .8 National Research Council (NRC)/Institute for Research in Construction
  - .1 NRCC 38728, National Plumbing Code of Canada (NPC).
  - .2 National Building Code of Canada.
- .9 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

## **1.2 Action And Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for specified equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

## **1.3 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.
- .4 Place materials defined as hazardous or toxic in designated containers.
- .5 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.
- .6 Develop Construction Waste Management Plan related to Work of this Section.
- .7 Packaging Waste Management: remove for reuse as specified in Construction Waste Management Plan and in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
- .8 Place materials defined as hazardous or toxic in designated containers.
- .9 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.

## **Part 2 Products**

### **2.1 Piping**

- .1 Domestic hot, cold and recirculation systems, within building, all sizes:
  - .1 Above ground: copper tube, hard drawn temper, type L: to ASTM B88M.
  - .2 Buried or embedded:
    - .1 Copper tube, soft annealed, type K: to ASTM B88M, in long lengths with no buried joints.
    - .2 Cross-linked polyethylene piping to Series 160 of CSA B137.9.

### **2.2 Fittings**

- .1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.

- .2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS 2 and larger: ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.
- .6 NPS 1 and smaller : wrought copper to ANSI/ASME B16.22; with 301stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

## **2.3 Joints**

- .1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5 tin copper alloy.
- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.
- .6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

## **2.4 Gate Valves**

- .1 NPS 2-1/2 and over, in mechanical rooms, flanged:
  - .1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim.
- .2 NPS 2-1/2 and over, other than mechanical rooms, flanged:
  - .1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet.

## **2.5 Globe Valves**

- .1 NPS2 and under, soldered:
  - .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, renewable PTFE disc, screwed over bonnet, bronze seat.
- .2 NPS 2 and under, screwed:
  - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, screwed over bonnet, renewable composition disc, bronze seat.
- .3 Provide lockshield handles where valve is used for balancing, such as in recirculation system.

## **2.6 Swing Check Valves**

- .1 NPS 3 and under, soldered:
  - .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, brass swing disc for sizes 19mm and under, bronze swing disc for sizes 25mm and greater, screw in cap.
- .2 NPS 3 and under, screwed:

- .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, brass swing disc for sizes 19mm and under, bronze swing disc for sizes 25mm and greater, screw in cap.

## **2.7 Ball Valves**

- .1 NPS 3 and under, screwed:
  - .1 To MSS-SP-110, Class 150, bronze body, chrome plated brass ball, brass stem, PTFE adjustable packing, PTFE seat, steel lever handle.
- .2 NPS 3 and under, soldered:
  - .1 To MSS-SP-110, Class 150, bronze body, chrome plated brass ball, brass stem, PTFE adjustable packing, PTFE seat, steel lever handle.

## **2.8 Butterfly Valves**

- .1 NPS 2-1/2 and over, grooved ends:
  - .1 Class 300, bubble tight shut-off, bronze body.
  - .2 Operator:
    - .1 NPS 6 and under: lever handles.

## **Part 3 Execution**

### **3.1 Application**

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### **3.2 Installation**

- .1 General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.
- .2 Install components having pressure rating equal to or greater than system operating pressure.
- .3 Install piping free of sags, bends, and kinks.
- .4 Install fittings for changes in direction and branch connections in hard drawn copper tube.
- .5 Install drains at low points and in trapped sections, to ensure entire system can be drained.
- .6 Install in accordance with NPC, Provincial Plumbing Codes and local authority having jurisdiction
- .7 Install pipe work in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified herein.
- .8 Assemble piping using fittings manufactured to ANSI standards.

- .9 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.
- .10 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .11 Buried tubing:
  - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
  - .2 Bend tubing without crimping or constriction. Minimize use of fittings.
- .12 Make provision for thermal expansion. Provide expansion tanks as required.

### **3.3 Piping Joint Construction**

- .1 Join pipe and fittings as follows:
  - .1 Ream ends of pipe and tube and remove burrs to restore full inside diameter.
  - .2 Remove scale, slag, dirt, and debris from inside and outside of pipe, tube, and fittings before assembly.
  - .3 Soldered Joints: Construct joints according to ASTM B 828.
  - .4 Brazed Joints: Construct joints according to ANSI/AWS C3.4.
  - .5 Threaded Joints: Construct in accordance with industry standard practices and manufacturer's recommendations.
  - .6 Flanged Joints: Construct in accordance with industry standard practices and manufacturer's recommendations.
  - .7 Mechanical Joints: Grooved copper tube and grooved-tube fitting joints shall be assembled with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's standard written procedure. Grooved ends on copper and copper alloy tube shall be roll-formed only using the appropriate roll-groove tool to construct a groove meeting the coupling and fitting manufacturer's written specifications. Cut grooving methods shall not be used on copper and copper alloy tube.

### **3.4 Piping Connections**

- .1 Make piping connections as specified below:
  - .1 Install solder-joint to male-thread adapters, or solder-joint to male-thread unions meeting the requirements of ASME B16.18 or ASME B16.22, adjacent to each threaded valve and threaded equipment connection in a copper tube system.
  - .2 Install ASME B16.24 cast copper alloy pipe flanges adjacent to each flanged valve and flanged equipment connection in a copper tube system.

### **3.5 Valves**

- .1 Isolate equipment, fixtures and branches with ball valves, unless otherwise indicated.
- .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

### **3.6 Pressure Tests**

- .1 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

### **3.7 Flushing, Cleaning And Disinfection**

- .1 Flush, clean and disinfect the entire system in accordance with applicable standards, to the requirements of the authority having jurisdiction.
- .2 Upon completion of flushing, cleaning and disinfection, draw off sample from longest run and submit to laboratory for testing. Provide laboratory test reports on water quality for Engineer approval.
- .3 Provide necessary fittings, valves and connections as required to flush, clean and disinfect the system

### **3.8 Pre-Start-Up Inspections**

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.
- .4 Ensure that air chambers, expansion compensators are installed properly.

### **3.9 Start-Up**

- .1 Timing: start up after:
  - .1 Pressure tests have been completed.
  - .2 Disinfection procedures have been completed.
  - .3 Certificate of static completion has been issued.
  - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
  - .1 Establish circulation and ensure that air is eliminated.
  - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
  - .3 Bring HWS storage tank up to design temperature slowly.
  - .4 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.
  - .5 Check control, limit, safety devices for normal and safe operation.
- .4 Rectify start-up deficiencies.

### **3.10 Performance Verification**

- .1 Scheduling:
  - .1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.
- .2 Procedures:
  - .1 Verify that flow rate and pressure meet Design Criteria.
  - .2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
  - .3 Sterilize HWS and HWC systems for Legionella control.

- .4 Verify performance of temperature controls.
- .5 Verify compliance with safety and health requirements.
- .6 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut off water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
- .7 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

### **3.11 Cleaning**

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

**END OF SECTION**



**Part 1 General**

**1.1 References**

- .1 ASTM International Inc.
  - .1 ASTM B32, Standard Specification for Solder Metal.
  - .2 ASTM B306, Standard Specification for Copper Drainage Tube (DWV).
  - .3 ASTM C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
  - .1 CSA B67, Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
  - .2 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
  - .3 CAN/CSA-B125.3, Plumbing Fittings.
- .3 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-36, Commercial Adhesives.
- .4 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1168, Adhesive and Sealant Applications.

**1.2 Action And Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for specified equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.3 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

**Part 2 Products****2.1 Copper Tube And Fittings**

- .1 Above ground sanitary, and vent: Type DWV to ASTM B306.
  - .1 Fittings.
    - .1 Cast brass: to ASME B16.23.
    - .2 Wrought copper: to ASTM/ASME B16.29.
  - .2 Solder and flux: to ASTM B32, ASTM B 813, ASTM B 828.

**Part 3 Execution****3.1 Application**

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

**3.2 Installation**

- .1 In accordance with Section 23 05 05 - Installation of Pipework.
- .2 Install in accordance with NPC, Provincial Plumbing Codes and local authority having jurisdiction

**3.3 Testing**

- .1 Hydraulically test to verify grades and freedom from obstructions.
- .2 Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - .1 Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - .2 Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - .3 Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 30 kPa (10-ft WC). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  - .4 Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 250 Pa (1-in wg). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

- .5 Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
- .6 Prepare reports for tests and required corrective action.

### **3.4 Performance Verification**

- .1 Cleanouts:
  - .1 Ensure accessible and that access doors are correctly located.
  - .2 Open, cover with linseed oil and re-seal.
  - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .4 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

### **3.5 Cleaning**

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

**END OF SECTION**

**Part 1 General**

**1.1 References**

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  - .1 ASHRAE 90.1, Energy Standard for Buildings except Low-Rise Residential Buildings
- .2 Electrical Equipment Manufacturers' Advisory Council (EEMAC)
- .3 Canadian Standards Association (CSA)
  - .1 CAN/CSA-C22.2 No. 100, Motors and Generators
  - .2 CAN/CSA-C747, Energy Efficiency for Single- and Three-Phase Small Motors
  - .3 CAN/CSA-C390, Energy Efficiency Test Methods for Three-Phase Induction Motors
- .4 Underwriter's Laboratories of Canada (ULC)
- .5 SMACNA
  - .1 HVAC Air Duct Leakage Test Manual
  - .2 HVAC Duct Construction Standards – Metal and Flexible

**1.2 Regulatory Requirements**

- .1 Refer carefully to other parts of the specifications.
- .2 Conform to the requirements and recommendations of all local municipal, provincial and federal codes, by-laws and ordinances.
- .3 Do not reduce the quality of work specified and/or shown on the drawings because of the Regulatory requirements.

**1.3 Applicable Codes And Standards**

- .1 In general and as applicable, the physical and chemical properties, the characteristics and the performance of items in this Division shall be as noted in the following:
  - .1 Canadian Standards Association.
  - .2 American National Standards Institute.
  - .3 Provincial Building Code.
  - .4 Civic Building By-Laws.
  - .5 Civic Water Works By-Laws and Sewer By-Laws.
  - .6 Provincial Fire Code.
  - .7 Worker's Compensation Board Requirements.
  - .8 American Society for Testing and Materials.
  - .9 Canadian Government Specifications Board.
  - .10 National Fire Protection Association.
  - .11 Canadian Council of Ministers of the Environment Codes.

.12 Underwriters' Laboratories of Canada.

#### **1.4 Latest Editions**

- .1 The latest edition of all codes and standards, of the date of tender submission, shall apply; except for specific editions referenced by overriding codes.

#### **1.5 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for specified equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province where work is taking place.
  - .2 Drawings to show:
    - .1 Mounting arrangements.
    - .2 Operating and maintenance clearances.
  - .3 Drawings and product data accompanied by:
    - .1 Detailed drawings of bases, supports, and anchor bolts.
    - .2 Acoustical sound power data, where applicable.
    - .3 Points of operation on performance curves.
    - .4 Manufacturer to certify current model production.
    - .5 Certification of compliance to applicable codes.
  - .4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

#### **1.6 Authorities Having Jurisdiction (Ahj)**

- .1 Comply with all requirements of Authorities with competent jurisdiction, AHJ, including authorized inspectors, without additional compensation.

#### **1.7 Permits, Fees And Certificates**

- .1 In addition to the requirements in Division 01, obtain all required Certificates of Inspection for the work and deliver same to the Departmental Representative before request for substantial performance. These include but are not limited to:
  - .1 Equipment start-up reports.
  - .2 Fire, smoke, and combination fire/smoke damper test reports.
- .2 Correct installed work as directed by the local Authorized Inspector of the Regulatory body without extra compensation.

#### **1.8 Equipment List**

- .1 Compile a complete list of HVAC equipment and materials to be used on this project and forming part of tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.

- .2 Submit for review within ten (10) days after award of contract.

## **1.9 Electrical Work**

- .1 Division 23 is responsible for the supply, physical installation, and operation of all electric motors, temperature and humidity controls systems, combustion controls systems, and other electrical devices and systems specified under its portion of the work. Bear full responsibility for factory installed wiring and equipment on packaged equipment, be responsible where detailed in equipment requirements for controlling devices such as, but not restricted to, pump and liquid level controls, multi-speed motor controllers, boiler controls, etc., which are necessarily integrally mounted on packaged equipment.
- .2 Submit detailed composite wiring diagrams for all control systems as specified and as required for the HVAC work for review by the Departmental Representative. Distribute copies of reviewed drawings to the Electrical Division for their reference.
- .3 Provide all wiring in approved rigid conduit to suit temperature and moisture conditions of area through which wire is to run. All wiring is in accordance with the relevant Electrical Codes, and in no case smaller than #12 AWG. Comply fully with the electrical specifications for all electrical work.

## **1.10 Electrical Characteristics**

- .1 Check with the electrical trade and provide all mechanical items with correct electrical characteristics to suit the electrical work.
- .2 If correct characteristics are not available from the specified equipment manufacturer, contact the Departmental Representative prior to the close of tenders.
- .3 At time of ordering HVAC equipment, confirm electrical characteristics with the electrical contractor, and ensure that they have been confirmed with the power authority.
- .4 No additional compensation will be paid for problems arising from incorrect electrical characteristics.

## **1.11 Cutting, Patching, Repairing, Making Good**

- .1 In addition to the requirements in Division 01, each trade requiring such work shall be responsible for necessary cutting. Patching by appropriate trade. All work to be performed by experienced tradesmen.
- .2 Neatly perform cutting and patching work to blend smoothly with surrounding surfaces.
- .3 Patch and make good disturbed surfaces to match existing adjacent work. Leave finished, neat, to Departmental Representative's approval.
- .4 Perform X-ray examination of wall and floors prior to making openings, where required to avoid damage to structural reinforcements and electrical conduits.

## **1.12 Tests**

- .1 In addition to the requirements in Division 01, carry out all tests hereinafter noted, as required by the regulatory agencies and as requested by the Departmental Representative and furnish all labour and equipment required for such tests without extra compensation.

- .2 Before activating systems, recheck equipment, check all connections, set all controls for proper start-up, obtain necessary clearances from the electrical division, etc.
- .3 Submit to the Departmental Representative, legible report for all tests conducted, within one week of the test.
- .4 Notify the Departmental Representative at least two (2) working days ahead of all tests, so that the tests can be witnessed on a random basis.

#### **1.13 Functional Testing**

- .1 Test all HVAC equipment, devices and systems. Test as required by the AHJ and Departmental Representative, submitting comprehensive reports. Example forms are available from the Departmental Representative.
- .2 Ensure all tests demonstrate compliance with the specified and manufacturers' shop drawing and catalogued performance, as well as compliance with applicable standards.

#### **1.14 Demonstration And Operating And Maintenance Instructions**

- .1 In addition to the requirements in Division 01, supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Manufacturers, or expert suppliers, to provide demonstrations and instructions.
- .3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Where deemed necessary, Departmental Representative or Owner may record these demonstrations on videotape for future reference.
- .6 Submit training schedule and scope description to the Departmental Representative for review and approval for each training topic. Training shall not commence until approval of training schedule and scope if given by the Departmental Representative.

#### **1.15 Spare Parts**

- .1 Not used

#### **1.16 Special Tools**

- .1 Provide one set of special tools required to service equipment in accordance with Section 01 78 00 - Closeout Submittals and as recommended by manufacturers.
- .2 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

#### **1.17 Closeout Submittals**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
  - .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.

- .2 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.
- .3 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .4 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.
  - .4 Testing, adjusting and balancing reports.
- .5 Approvals:
  - .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .6 Additional data:
  - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
  - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. [Include changes to existing mechanical systems, control systems and low voltage control wiring].
  - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection.
- .8 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS



BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS  
INSTALLED" (Signature of Contractor) (Date).

- .3 Submit to Departmental Representative for approval and make corrections as directed.
- .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
- .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

#### **1.18 Maintenance Material Submittals**

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

#### **1.19 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

#### **1.20 Substantial Completion / Certification By Engineer / Life Safety Submissions**

- .1 Provide minimum notice of ten (10) working days to the Departmental Representative prior to request to declare project substantially complete. Failure to do so may result in site review by Engineer being delayed.
- .2 In addition to the requirements of Division 01 submit the following (as applicable) a minimum of five (5) working days ahead of required proposed date of substantial completion (unless a longer period of time is dictated by Authorities Having Jurisdiction):
  - .1 All certificates and documentation required by Authorities Having Jurisdiction.
  - .2 Fire and smoke damper test reports.
  - .3 Smoke exhaust/management systems commissioning reports
  - .4 Equipment start-up reports.
  - .5 Control systems commissioning reports pertaining to equipment/systems required for life safety system operation (i.e. ventilation interlocks/unit operation, CO detection/exhaust systems, etc.).
  - .6 Test reports for backflow prevention devices with test taps.
  - .7 Written confirmation that propane system is approved by the utility and/or Authority Having Jurisdiction, and turned on.
  - .8 Record ('As-Built') drawings.
  - .9 Operation and Maintenance Manuals, complete with revisions as directed.
  - .10 Written confirmation that all life safety and health systems are fully functional, including but not limited to ventilation, both supply and exhaust.

- .11 Written confirmation that all HVAC equipment is operational and under control, indicating exceptions and temporary controls/arrangements.
- .12 All other life safety and health reports and certificates.
- .3 Confirm, in writing, systems are ready for occupancy and use for intended purpose in every respect.
- .4 Before certification date submit detailed written confirmation of completion of deficient life safety work noted in the documentation listed above, including date completed.
- .5 Before certification date submit detailed written confirmation of completion of deficient non-life safety work, including that noted in Departmental Representative reports, listing each deficient item. Submit schedule for completion of all deficient non-life safety work that will not be completed prior to the certification date, listing each deficient item for consideration.
- .6 These requirements apply to each phase of a phased project.

## **1.21 Fan Connections**

- .1 Inlet and discharge conditions are critical to proper fan performance. Review proposed fan installations and ensure that proper conditions are provided; add straightening vanes or turning vanes where required.
- .2 In general, provide a minimum of three (3) wheel diameters of straight duct immediately upstream of the fan inlet.
- .3 Review special cases with the Departmental Representative and TAB Contractor prior to installation.

## **Part 2 Products**

### **2.1 Fire Separation Repair**

- .1 Refer to Section 07 84 00 – Firestopping.
- .2 Cooperate fully with other trades to ensure maintenance of the rating of fire separations that are penetrated, in strict compliance with the manufacturer's recommendations and requirements of the AHJ.

### **2.2 Accessibility**

- .1 Refer also to Section 10 90 00 – Miscellaneous Specialties for access door specification.
  - .1 Standard Type:
    - .1 Door and Trim: 14 gauge steel. Trim 1-1/2 inches wide.
    - .2 Return Frame: 18 gauge steel. Depth 1-3/4 inches.
    - .3 Hinges: Fully-concealed. Opens 170 degrees. On long side of door. Number of hinges
    - .4 varies with size of door.
    - .5 Latches: Flush, stainless steel cam-operated with screwdriver. Positioned opposite hinge
    - .6 and at top and bottom on larger sizes.

- .7 Finish: Electrostatically-applied, baked grey enamel coat over rust-inhibiting phosphate
  - .8 treated steel.
  - .9 Masonry Anchor Straps: Minimum of 4 straps per door, where required
  - .10 Cylinder Lock: Keyed alike with 2 keys per lock.
  - .11 Gaskets: Weather-resistant and air-tight neoprene gaskets.
- .2 Fire Rated Type:
  - .1 UL Listed: rating to match assembly being installed in, 250 degrees C (450 degrees F) maximum temperature rise in 30 minutes for vertical wall installations.
  - .2 Frame: 16 gauge steel, 2 ½ inches deep.
  - .3 Insulation: 2 inches thick mineral wool in between 2 pieces of 22 gauge steel.
  - .4 Hinge: Continuous piano hinge allows opening to 180 degrees. Hinge is on long side of door.
  - .5 Latches: Specially designed Ultra Lock-self-latching keyed cylinder paddle latch opposite hinge.
  - .6 Automatic panel closer on all doors. Vertical position only. Ceiling position has self-assisted closing.
  - .7 Inside panel release on all doors.
  - .8 rust-inhibiting phosphate treated steel. This coating can be used as a finish or as a prime coat.
  - .9 Finish: Electrostatically-applied, baked grey enamel coat over rust-inhibiting phosphate treated steel.
  - .10 Hot smoke seal gasketing for 4 sides.
- .2 Be responsible for supplying and locating all access panels in the ceiling, wall, partitions, etc., where openings are necessary for the inspection, servicing and/or removal of equipment, valves and other items that require periodic access. Panel type to suit the construction of the ceilings, walls, partitions, etc., in which they are located. Determine the location subject to the approval of the Departmental Representative. Access panels to be installed by trade experienced in work with surface in which the panel is to be installed.
- .3 Mark mechanical access points in accessible ceilings with distinctive but inconspicuous tags properly attached to the ceiling grid. Obtain sample approval before purchase and installation. Indicate on record drawings.
- .4 Accessibility shall be defined as:
  - .1 Ability to place both hands on equipment or device, with no duct, pipe or other equipment in the way.
  - .2 Must be accessible while standing on maximum 2400 mm high stepladder.
  - .3 Must be in plain view.
- .5 Mark mechanical access points in accessible ceilings with distinctive but inconspicuous tags properly attached to the ceiling grid. Obtain sample approval before purchase and installation. Indicate on record drawings.

## **2.3 Sleeves And Penetrations**

- .1 Install sleeves for all piping passing through floors and walls.
- .2 Sleeves as specifically noted, or through structural walls shall be Schedule 40 steel. All other sleeves are 6 mm galvanized sheet steel.
- .3 Fit sleeves flush on either side of the wall through which they pass, extend sleeves through floors and terminate 50 mm above finished floor. Adjust as necessary to accommodate the requirements of through-penetration fire-stopping systems.
- .4 Where passing through walls, make sleeves a minimum 6 mm clear of the piping, through floors make sleeves a minimum of 20 mm clear of the piping. Pack for full depth with fiberglass insulation & finish with a lagging compound. Penetrations through fire separations shall be repaired to maintain rating.
- .5 Provide escutcheon plates with setscrews to completely cover openings for all exposed pipes passing through walls, subject to the approval of the Departmental Representative. Provide chrome-plated plates in finished areas unless otherwise approved.
- .6 Be responsible for maintaining integrity of building envelope when making penetration to install equipment or devices. Enlist services of qualified trade to make openings in and/or repairs to building envelope.
- .7 Sleeving through steel beams shall be permitted only where approved by the Departmental Representative in writing or where expressly indicated on the Contract Documents. Sleeves are NOT permitted in concrete beams.
- .8 Seal all sleeves to make watertight.

## **2.4 Counter Flashings**

- .1 In addition to the requirements in Division 01, provide watertight, non-corroding, counter flashings for all penetrations of the building envelope, painted to match adjacent materials after proper preparation and painting. Refer to drawings, including building drawings, for additional information.
- .2 Installation to allow for movement and accommodate high temperatures where necessary.
- .3 For short pipes, the flashing may overlap the end, in lieu of attachment to the pipe. Minimum 300 mm high above the roof, c/w water break above maximum water level on the roof, to negate wind effects.
- .4 All galvanized material to be 0.7 mm thick minimum.
- .5 In exposed locations, flashings must be aesthetically acceptable to the Departmental Representative.
- .6 Co-ordinate with all other trades including roofer and metal wall panel installer.
- .7 For copper pipe use 0.82 mm sheet copper, soldered to pipe end c/w solder joints.
- .8 For galvanized ducts use galvanized sheet metal soldered to the duct and c/w soldered joints.
- .9 For cast iron and steel pipes at normal temperature, use manufactured stretch fit heavy neoprene flashings c/w galvanized protective layer.
- .10 For hot pipes clamp galvanized to the pipe with a temperature rated gasket and stainless steel worm gear clamp.

- .11 For aluminum and stainless steel, use the same materials for the flashing.
- .12 For manufactured hoods, fans and rooftop unit mounting, apply a low density neoprene gasket all around and fasten securely.

### **Part 3 Execution**

#### **3.1 General**

- .1 All Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Do not scale the Drawings. Consult the Architectural Drawings and details for exact locations of fixtures and equipment; where some are not definitely located, obtain this information from the Departmental Representative.
- .2 Follow Drawings as closely as possible in laying out work and check Drawings of all other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. When headroom or space conditions appear inadequate, notify the Departmental Representative before proceeding with the installation.
- .3 Make reasonable modifications in the layout as needed without extra compensation to prevent conflicts with work of other trades or for proper execution of the work. This shall include, but not necessarily be confined to, offsets in piping or ducts, transformation in ductwork and relocation of ducts and piping up to 3.0 m either way on each item as required to suit on site job conditions.
- .4 Where variances occur between the Drawings and Specifications or within either document itself, include in the contract, the item or arrangement of better quality, greater quantity, and higher cost or clarify before tenders close. The final decision on the item and manner in which work is installed rests with the Departmental Representative.
- .5 Provide, with all trades involved, marked-up drawings, when requested, of mechanical spaces indicating all dimensions for all installations prior to the work being done. Report any discrepancies to the Departmental Representative. Any conflicts arising that may have been resolved by laying the work out in this manner will be resolved WITHOUT ADDITIONAL COMPENSATION.
- .6 Provide 48 hours minimum notice to Departmental Representative and Owner of all work before it is concealed. Expose concealed work for inspection, upon request, when proper notice was not provided and pay all costs therefore, including making good other trades' work.

#### **3.2 Surveys And Measurements**

- .1 Base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements shown on the Drawings at the site, and check the correctness of same as related to the work.
- .2 Notify the Departmental Representative if any discrepancy is discovered between the actual measurements and those indicated which prevent following good practice or the intent of the Drawings & Specifications. Do not proceed with the work until receiving instructions from the Departmental Representative.

### **3.3 Co-Ordination**

- .1 Give full co-operation to those doing work under other Divisions of the specifications and furnish in writing with copies to the Departmental Representative any information necessary to permit the work of all Divisions to be installed satisfactorily and with least possible interference or delay.
- .2 Discuss work with other Divisions prior to installation. Confirm proposed locations for equipment installed by this Division will not interfere with work installed by others.
- .3 If work is installed before coordinating with other trades or so as to interfere with work of other trades, make necessary changes in the work to correct the conditions without extra compensation.
- .4 When requested, provide marked up drawings indicating required clearances for installation of plumbing equipment. Provide section drawings indicating location of other equipment not installed by Division 23, such as other equipment and piping,, cable trays, etc. Report any discrepancies to the Departmental Representative.

### **3.4 Accessibility**

- .1 Locate all equipment that must be serviced, operated or maintained in fully accessible positions, with minimum interference and maximum usable space. If required for better accessibility, furnish access doors for this purpose. Make deviations from Drawings to allow for good accessibility, obtaining prior approval for changes of magnitude.

### **3.5 Scaffolding, Rigging, Hoisting**

- .1 Unless otherwise specified, furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment apparatus furnished. Remove same from the premises when no longer required.
- .2 Take precautions not to overload the structure in any manner nor provide inadequate scaffolding and rigging so as to endanger the safety of personnel on the site whether under this Division's employ or otherwise.

### **3.6 Cutting And Patching**

- .1 Cutting shall be performed neatly by this trade. No hammering or other methods are permitted without approval of the Departmental Representative and other trades affected. Utilize a rebar detector and stud finder to ensure cutting does not damage other elements.
- .2 Patching is to be done by the appropriate trade. Arrange and pay for all patching not specifically specified elsewhere in these specifications, including fire rated patching at fire separations.
- .3 Fill voids around pipes and ducts with fiberglass batt insulation and sheet metal closure strips. For fire separations, install fire stop material in accordance with manufacturer's details as required to meet the UL classification and to match separation rating. Ventilate adequately during curing. Provide adequate structural support in larger spaces. Install slightly above floors to provide positive drainage away from pipe or duct.
- .4 Provide a structural shop drawing stamped by a Professional Engineer showing all reinforcements required for openings through the structure. Allow for all costs of the reinforcement.

### **3.7 Supports**

- .1 Provide all necessary and recommended supports for all equipment furnished under this Division. Co-ordinate and facilitate all necessary and recommended foundations, pads, bases and piers provided under other Divisions for equipment furnished or installed under this Division.

### **3.8 Waterproofing**

- .1 Obtain approval for the installation method employed where any work pierces waterproofing concrete and waterproofing. Furnish all necessary grout rings sleeves, caulking, curbs, counter flashing and flashing required to make openings through roofs, walls, floors, etc., absolutely watertight. This applies to, but is not restricted to, roof exhausters, relief vents, penthouses, ducts, grilles, pipes, etc. Work involving the roofing is done in conjunction with the roofing Division. Work passing through roofing is to be done in accordance with applicable C.R.C.A. "FL" Series details.

### **3.9 Protection**

- .1 Protect the work and material of all other sections from damage and make good all damage thus caused, to the satisfaction of the Departmental Representative.
- .2 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

### **3.10 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.11 Painting Repairs And Restoration**

- .1 Do painting in accordance with Section 09 91 23 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

### **3.12 System Cleaning**

- .1 Clean interior and exterior of all systems including strainers.
- .2 Duct Cleaning:
  - .1 Applicable to systems within the area of work and systems that may be affected by the work taking place in this project.
    - .1 Isolate all systems exterior to the area of work where possible.
  - .2 Thoroughly clean all new and existing ductwork.
  - .3 Segregate points of access to fan chambers, plenums, larger diameter ducting etc. from adjacent occupied areas.

- .4 Supply and install access doors in ductwork, plenums, etc. at locations required to complete work specified.
- .5 Work shall include the cleaning of plenums, diffusers, air handling units, fans and all other mechanical equipment which combined forms part of the buildings ventilation system. This shall include, but not limited to the following:
  - .1 Interior surfaces of all ductwork
  - .2 Interior surfaces of air handling units to include but not limited to plenums, fan(s), fan chambers, coils, dampers, filters, motor(s), louvres, etc.
  - .3 Surfaces of coils, dampers, louvres, turning vanes, diffusers, registers, grilles and all other equipment present with or which forms part of the air systems
- .6 Provide drop sheet beneath all points where access to ducting or equipment will be made.
- .7 Seal openings in ducting and equipment using polyethylene and tape to prevent the spread of dust and to assist in establishing negative pressure.
- .8 Ensure each branch line is cleaned from each diffuser or grill, along with the entire length of the duct back to the main inclusive.
- .9 Portable vacuum system may only be used on ducting with a circumference less than 48 in or less; use truck mounted vacuum system on ducting with larger circumference.
- .10 Coils, fan blades, etc. shall be pressure washed with non toxic, non corrosive approved detergent germicide solution applied with low volume, high pressure wash unit. In addition, coils will be brushed, scraped and vacuumed as necessary.
- .11 Dust and film build-up shall be cleaned from all surfaces of the building ventilation system which come into contact with circulating air.
- .12 Provide necessary access openings in ductwork at locations required to complete the work. Repair openings following completion of work as follows:
  - .1 Access holes smaller than 10"x10" shall be re-sealed in an airtight manner using 24 gauge cross broken sheet metal, sheet metal screws and duct sealant.
  - .2 Supply and install specified access doors to re-seal openings greater than 12"x12".
- .13 Establish negative pressure within system prior to and throughout the cleaning process.
- .14
- .15 Schedule work following the complete of all work by other trades that may generate airborne construction debris. Ensure work of this section is completed prior to starting or testing of building systems.
- .16 Ensure electrical power supply to all air handling equipment is locked out and tagged. System to remain inoperable during cleaning process
- .17 Use of compressed air to aid the cleaning process is only permitted where access by the worker is not possible and the use can safely be controlled by the worker from the exterior of the ducting. Use of compressed air by a worker or while a worker is present within larger diameter ducting, air handler, plenums, etc is prohibited for safety reasons.



### **3.13 Field Quality Control**

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report.
- .2 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### **3.14 Cleaning**

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

### **3.15 Protection**

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

### **3.16 Equipment Start-Up**

- .1 HVAC contractor shall ensure that all electrical/HVAC components match and that it is safe to start-up HVAC equipment.
- .2 All support such as electrical contractor, controls contractor, etc., shall be arranged by the mechanical and all trades directly involved in equipment being started shall be present for start-up.

### **3.17 Manufacturers' Recommendations**

- .1 Install, adjust, test, start-up, and maintain all equipment in strict accordance with the manufacturer's recommendations. If in conflict with the drawings and specifications, contact the Departmental Representative for clarification.
- .2 Ensure that the manufacturer recommends the product for its intended use. If in doubt, contact the Departmental Representative.

### **3.18 Personnel Protection**

- .1 In addition to the requirements in Division 01, provide visual warning signs and/or markers and mechanical protection devices for all mechanical items mounted below the minimum limits listed below and suspended more than 1500mm clear of the floor.
  - .1 Occupied spaces 2286 mm (7'-6").

- .2 Service spaces 2133 mm (7'-0").
- .3 Crawl spaces 1524 mm (5'-0").
- .2 Visual warning devices to be yellow tape with black stripes adhered to the entire perimeter of the item infringing on the occupied space. This will include but not be limited to:
  - .1 Length of pipes or equipment below specified height.
- .3 Mechanical protection devices to be 7 mm (1/4") wire mesh guard and/or 25 mm thick 'Armaflex' type insulation. This will include but not be limited to:
  - .1 Pipe and equipment hangers.
  - .2 Valves.

**END OF SECTION**

**Part 1 General**

**1.1 References**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.181-[99], Ready-Mixed Organic Zinc-Rich Coating.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA B139, Installation Code for Oil Burning Equipment.
- .3 Green Seal Environmental Standards (GSES)
  - .1 Standard GS-11-, 2nd Edition], Environmental Standard for Paints and Coatings.
- .4 National Fire Code of Canada (NFCC 2005)
- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113, Architectural Coatings.
  - .2 SCAQMD Rule 1168, Adhesive and Sealant Applications.

**1.2 Action And Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for specified equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.3 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 Material**

- .1 Paint: zinc-rich to CAN/CGSB-1.181.

- .2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
- .3 Fire Stopping: in accordance with Section 07 84 00 - Fire Stopping.

## **Part 3 Execution**

### **3.1 Application**

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### **3.2 Connections To Equipment**

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

### **3.3 Clearances**

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and CSA B139.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer without interrupting operation of other system, equipment, components.

### **3.4 Drains**

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain.
  - .1 Discharge to be visible.
- .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

### **3.5 Air Vents**

- .1 Install automatic air vents at high points in piping systems.
- .2 Install isolating valve at each automatic air valve.
- .3 Install drain piping to approved location and terminate where discharge is visible.

### **3.6 Dielectric Couplings**

- .1 General: compatible with system, to suit pressure rating of system.
- .2 Locations: where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.

- .4 Over NPS 2: isolating flanges.

### **3.7 Pipework Installation**

- .1 Install pipework to CSA B139.
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material.
- .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .5 Assemble piping using fittings manufactured to ANSI standards.
- .6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
  - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .8 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .10 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .11 Group piping wherever possible and as indicated.
- .12 Ream pipes, remove scale and other foreign material before assembly.
- .13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .14 Provide for thermal expansion as indicated.
- .15 Valves:
  - .1 Install in accessible locations.
  - .2 Remove interior parts before soldering.
  - .3 Install with stems above horizontal position unless indicated.
  - .4 Valves accessible for maintenance without removing adjacent piping.
  - .5 Install globe valves in bypass around control valves.
  - .6 Use valves at branch take-offs for isolating purposes except where specified.
  - .7 Install butterfly valves between weld neck flanges to ensure full compression of liner.
  - .8 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.
- .16 Check Valves:
  - .1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.
  - .2 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

### **3.8 Sleeves**

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 black steel pipe.
- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
  - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
  - .2 Other floors: terminate 25 mm above finished floor.
  - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
- .6 Sealing:
  - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
  - .2 Elsewhere:
    - .1 Provide space for firestopping.
    - .2 Maintain fire rating integrity.
  - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
  - .4 Ensure no contact between copper pipe or tube and sleeve.

### **3.9 Escutcheons**

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: one-piece type with set screws.
  - .1 Chrome or nickel plated brass or type 302 stainless steel.
- .3 Sizes: outside diameter to cover opening or sleeve.
  - .1 Inside diameter to fit around pipe or outside of insulation if so provided.

### **3.10 Preparation For Fire Stopping**

- .1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.
- .2 Uninsulated unheated pipes not subject to movement: no special preparation.
- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

### **3.11 Flushing Out Of Piping Systems**

- .1 Before start-up, clean interior of piping systems in accordance with local requirements
- .2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

### **3.12 Pressure Testing Of Equipment And Pipework**

- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
- .2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Departmental Representative.
- .6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

### **3.13 Existing Systems**

- .1 Connect into existing piping systems at times approved by Departmental Representative.
- .2 Request written approval by Departmental Representative days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.

### **3.14 Cleaning**

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

**END OF SECTION**

## **Part 1 General**

### **1.1 Summary**

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

### **1.2 Qualifications Of Tab Personnel**

- .1 Submit names of personnel to perform TAB to Departmental Representative within 30 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
  - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1.
  - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
  - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
  - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
  - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

### **1.3 Purpose Of Tab**

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads



- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

#### **1.4 Exceptions**

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

#### **1.5 Co-Ordination**

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

#### **1.6 Pre-Tab Review**

- .1 Review contract documents before project construction is started confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Departmental Representative in writing proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

#### **1.7 Start-Up**

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

#### **1.8 Operation Of Systems During Tab**

- .1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

#### **1.9 Start Of Tab**

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
- .3 Installation of ceilings, doors, windows, other construction affecting TAB.
- .4 Application of weatherstripping, sealing, and caulking.
- .5 Pressure, leakage, other tests specified elsewhere Division 23.
- .6 Provisions for TAB installed and operational.
- .7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

- .1 Proper thermal overload protection in place for electrical equipment.
- .2 Air systems:
  - .1 Filters in place, clean.
  - .2 Duct systems clean.
  - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
  - .4 Correct fan rotation.
  - .5 Fire, smoke, volume control dampers installed and open.
  - .6 Coil fins combed, clean.
  - .7 Access doors, installed, closed.
  - .8 Outlets installed, volume control dampers open.
- .3 Liquid systems:
  - .1 Flushed, filled, vented.
  - .2 Correct pump rotation.
  - .3 Strainers in place, baskets clean.
  - .4 Isolating and balancing valves installed, open.
  - .5 Calibrated balancing valves installed, at factory settings.
  - .6 Chemical treatment systems complete, operational.

#### **1.10 Application Tolerances**

- .1 Do TAB to following tolerances of design values:
  - .1 Laboratory HVAC systems: plus 10 %, minus 0] %.
  - .2 Other HVAC systems: plus 5 %, minus 5 %.
  - .3 Hydronic systems: plus or minus 10 %.

#### **1.11 Accuracy Tolerances**

- .1 Measured values accurate to within plus or minus 2 % of actual values.

#### **1.12 Instruments**

- .1 Prior to TAB, submit to Departmental Representative list of instruments used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

#### **1.13 Action And Informational Submittals**

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

#### **1.14 Preliminary Tab Report**

- .1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

- .1 Details of instruments used.
- .2 Details of TAB procedures employed.
- .3 Calculations procedures.
- .4 Summaries.

**1.15 Tab Report**

- .1 Format in accordance with referenced standard.
- .2 TAB report to show results in SI units and to include:
  - .1 Project record drawings.
  - .2 System schematics.
- .3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in English in D-ring binders, complete with index tabs.

**1.16 Verification**

- .1 Reported results subject to verification by Departmental Representative.
- .2 Provide personnel and instrumentation to verify up to 30% of reported results.
- .3 Number and location of verified results as directed by Departmental Representative.
- .4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

**1.17 Settings**

- .1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, and ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

**1.18 Completion Of Tab**

- .1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

**1.19 Air Systems**

- .1 Standard: TAB to most stringent of this section.
- .2 Do TAB of systems, equipment, components, controls specified Division 23 and as follows:
  - .1 Supply air systems as indicated on drawings
  - .2 Test and tag all fire dampers
- .3 Qualifications: personnel performing TAB current member in good standing of AABC and NEBB.
- .4 Quality assurance: perform TAB under direction of supervisor qualified by AABC and NEBB.
- .5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures

(dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

- .6 Locations of equipment measurements: to include as appropriate:
  - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
  - .2 At controllers, controlled device.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

## **1.20 Other Tab Requirements**

- .1 General requirements applicable to work specified this paragraph:
  - .1 Qualifications of TAB personnel: as for air systems specified this section.
  - .2 Quality assurance: as for air systems specified this section.
- .2 Zone pressure differences:
  - .1 Adjust HVAC systems, equipment, controls to establish specified air pressure differentials, with systems in every possible combinations of normal operating modes.

## **Part 2 Products**

### **2.1 Not Used**

- .1 Not used.

## **Part 3 Execution**

### **3.1 Not Used**

- .1 Not used.

**END OF SECTION**

**Part 1 General**

**1.1 Summary**

- .1 The scope of work involves the installation of new ductwork and modification to existing ductwork to accommodate floor plan changes and renovations.
- .2 All ductwork, new and modified, shall be installed as per this section.

**1.2 References**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
  - .1 ASHRAE Handbook – Fundamentals.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM A924/A924M, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/ULC-S109M, Standard for Flame Tests of Flame-Resistant Fabrics and Films.
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  - .1 HVAC Duct Construction Standards - Metal and Flexible.
  - .2 HVAC Air Duct Leakage Test Manual.

**1.3 Shop Drawings And Product Data**

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

**1.4 Closeout Submittals**

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**Part 2 Products**

**2.1 Galvanized Steel**

- .1 Lock forming quality: to ASTM A653/A653M, G90/Z275 zinc coating, with tolerances to ASTM A924/A924M.
- .2 Thickness, fabrication and reinforcement: to SMACNA HVAC Duct Construction Standards.

- .3 Joints: to SMACNA HVAC Duct Construction Standards.

## **2.2 Pressure Classification**

- .1 Pressure Class: to match maximum design external static pressure of fans systems.

## **2.3 Ductwork**

- .1 Construction - round and oval.
  - .1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA HVAC Duct Construction Standards.
  - .2 Transverse joints up to 900 mm: slip type with tape and sealants.
  - .3 Transverse joints over 900 mm: Vanstone flanges.
- .2 Construction - rectangular:
  - .1 Ducts: factory fabricated to SMACNA HVAC Duct Construction Standards.
  - .2 Transverse joints: to SMACNA HVAC Duct Construction Standards.

## **2.4 Fittings**

- .1 Fabrication: to SMACNA HVAC Duct Construction Standards.
- .2 Radiused elbows:
  - .1 Rectangular: smooth radius. Centreline radius: 1.5 times width of duct.
  - .2 Round and oval: smooth radius or five-piece (for 90 degrees) and three-piece (for 45 degrees). Centreline radius: 1.5 times duct diameter.
- .3 Mitred elbows:
  - .1 To 750 mm duct height in plane of turn: with single-thickness turning vanes.
  - .2 Over 750 mm duct height in plane of turn: with double-thickness turning vanes.
- .4 Branches:
  - .1 Rectangular main and branch: connection with 45 degree entry.
  - .2 Round main and branch: conical connection.
  - .3 Provide volume control damper in branch duct near connection to main duct.
- .5 Transitions:
  - .1 Diverging: 10 degrees maximum angle each side; 20 degrees maximum included angle for symmetrical fittings.
  - .2 Converging: 22.5 degrees maximum angle each side; 45 degrees maximum included angle for symmetrical fittings.
- .6 Offsets:
  - .1 Full radiused or mitred elbows: as specified above.
- .7 Obstruction deflectors: maintain full cross-sectional area of duct.
  - .1 Maximum included angles: as for transitions.

## 2.5 Seal Classification

- .1 Seal class:

Systems	Pressure Class (Pa)	Seal class
Supply air system	+250	B

- .2 Seal Classification:

- .1 Class B: longitudinal seams, transverse joints and connections made airtight with sealant and tape or combination thereof.

## 2.6 Sealant

- .1 Sealant: oil resistant, water-based, polymer type flame resistant duct sealant.
- .2 Flame spread rating shall not exceed 25 and smoke developed classification shall not exceed 50.
- .3 Operational temperature range of minus 32 degree C to plus 93 degree C. Application temperature range of plus 4 degree C to plus 43 degree C.

## 2.7 Reinforcing Tape

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.
- .2 Meets the flame-resistance requirements of CAN/ULC-S109M.

## 2.8 Hangers And Supports

- .1 Hangers and Supports:
- .1 Hanger configuration, design, and construction: to SMACNA HVAC Duct Construction Standards.
- .2 Strap hangers: Maximum rectangular duct size supported by strap hanger: 500 mm on longest side.
- .1 Straps of same material as duct but next sheet metal thickness heavier than duct.
- .2 Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- .3 Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- .3 Band hangers: of same material as duct but next sheet metal thickness heavier than duct.
- .1 Maximum round or oval duct size supported by strap hanger: 500mm diameter.
- .4 Trapeze hangers and Riser Supports: ducts over 500 mm diameter or longest side, to SMACNA HVAC Duct Construction Standards.

- .1 Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
- .2 Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
- .3 Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.
- .5 Hangers: galvanized steel angle with galvanized steel rods to SMACNA HVAC Duct Construction Standards.
- .6 Upper hanger attachments:
  - .1 For concrete: manufactured concrete inserts.
  - .2 For steel joist: manufactured joist clamps.
  - .3 For steel beams: manufactured beam clamps.
- .7 Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

## **Part 3 Execution**

### **3.1 General**

- .1 Do work in accordance with SMACNA HVAC Duct Construction Standards unless directed otherwise by Engineer.
- .2 First class workmanship is required for fabrication and installation. Submit samples and/or detailed shop drawings of different types of fittings, joints, supports, sealants, etc, when requested by the Engineer.
- .3 Locate ductwork approximately as shown on drawings unless otherwise prevented by jobsite conditions. Carefully coordinate duct layouts with other services, particularly where exposed in occupied spaces. Conceal all ductwork unless otherwise directed and approved by the Engineer. Report all layout deviations to the Engineer for approval prior to installation.
- .4 Construct ducts in accordance with the dimensions shown on the drawings. Alter the duct dimensions, while maintaining the equivalent round duct diameter, where necessitated by jobsite conditions. Equivalent duct dimensions to be determined using ASHRAE Handbook duct design procedures.
- .5 Duct dimension shown on drawings are inside dimensions. If ducts are internally lined or insulated, increase duct size such that clear dimensions after application of lining/insulation are equal to those shown on drawings.
- .6 Adjust duct dimensions to suit standard control damper sizes.
- .7 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .8 Support risers at each floor penetration. Provide neoprene pads between riser supports and the building structure. On exposed ductwork, provide galvanized angle collars to conceal the above work on both sides of the floor penetration.



- .9 Lap all joints in the direction of air flow wherever possible.
- .10 Provide a smooth interior surface at all seams and joints.
- .11 Provide a straight collar, not less than 300 mm long, at the connection to each diffuser. Where this is not possible provide adjustable multi-blade type flow equalizing grid in the diffuser neck.

### **3.2 Fittings**

- .1 Fitting geometry to be in accordance with specifications and drawing details unless otherwise directed and approved by the Engineer.
- .2 Provide mitred elbows with turning vanes where jobsite conditions prevent installation of radiused elbows.

### **3.3 Hangers**

- .1 Strap and band hangers: install in accordance with SMACNA HVAC Duct Construction Standards.
- .2 Angle hangers: install in accordance with SMACNA HVAC Duct Construction Standards, complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA HVAC Duct Construction Standards.
- .4 Do not break continuity of insulation vapour barrier with hangers or rods.

### **3.4 Sealing And Taping**

- .1 Apply sealant to outside of joint in accordance with SMACNA HVAC Duct Construction Standards and to manufacturer's recommendations.
- .2 Use reinforcing tape on all ducts with seal Class A; ducts with seal Class B or C and a pressure classification in excess of 500 Pa; and for larger gaps.
- .3 Bed reinforcing tape in sealant and recoat with minimum of one coat of sealant to manufacturer's recommendations.
- .4 Seal all joints including, but not limited to, at coils, terminal units, grilles and diffusers.
- .5 Eliminate all audible noise caused by air leakage.

### **3.5 Watertight Duct And Drip Pans**

- .1 Provide watertight duct for:
  - .1 Intake and relief air outlets.
    - .1 Ductwork connect from ERV unit to outdoors
  - .2 Outside air intakes.
  - .3 As directed by Engineer.
- .2 Provide watertight evaporative pan below:

- .1 Intake and relief air outlets.
  - .1 Beneath roof hoods for ERV unit
- .3 Form bottom of horizontal duct or drip pan without longitudinal seams.
  - .1 Solder or weld joints of bottom and side sheets.
  - .2 Seal other joints with duct sealer.
- .4 Slope horizontal branch ductwork down towards hoods served.
  - .1 Slope header ducts down toward risers.
- .5 Fit base of riser with 150 mm deep drain sump and 25 mm drain, with deep seal trap and trap primer, discharging to open funnel or hub drain.
- .6 Drip pan to be 75 mm wider all around ductwork or equipment served and complete with 75 mm deep drain sump. Elevated drip pans to be provided with 25 mm drain discharging to open funnel or hub drain. Provide sufficient clearance above drip pan to facilitate access and to permit unimpeded airflow to equipment or intake above.
- .7 Provide angle iron supports under sumps and drip pans adequate to support weight when full.
- .8 Install drip pans level to maximize holding capacity.
- .9 Fill sumps and drip pans with water to demonstrate strength, level and waterproof, when requested by Engineer.

### **3.6 Leakage Tests**

- .1 Conduct tests in accordance with SMACNA HVAC Duct Leakage Test Manual.
- .2 Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
- .3 Coordinate testing requirements with the TAB contractor who will perform leakage tests. Provide temporary caps and make duct modifications required to conduct the tests.
- .4 Do leakage tests in sections.
- .5 Leakage testing shall include HVAC equipment and terminal units. Where sections include equipment and terminal units, do not perform leakage testing until final connections have been made.
- .6 Conduct trial leakage tests to demonstrate workmanship.
- .7 Do not install additional ductwork until trial tests have been passed.
- .8 Complete testing before installation of insulation or concealment Work.

- .9 Give seven days' advance notice for testing.

**END OF SECTION**

**Part 1 General**

**1.1 References**

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

**1.2 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for [air duct accessories] and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate:
    - .1 Flexible connections.
    - .2 Duct access doors.
    - .3 Turning vanes.
    - .4 Instrument test ports.

**1.3 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse as specified in Construction Waste Management Plan.

**Part 2 Products**

**2.1 General**

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

**2.2 Flexible Connections**

- .1 Frame: galvanized sheet metal frame thick with fabric clenched by means of double locked seams.
- .2 Material:

- .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m2.

## **2.3 Access Doors In Ducts**

- .1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.
- .2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:
  - .1 Up to 300 x 300 mm: two sash locks complete with safety chain.
  - .2 301 to 450 mm: four sash locks complete with safety chain.
  - .3 451 to 1000 mm: piano hinge and minimum two sash locks.
  - .4 Doors over 1000 mm: piano hinge and two handles operable from both sides.
  - .5 Hold open devices.
  - .6 300 x 300 mm glass viewing panels.

## **2.4 Turning Vanes**

- .1 Factory or shop fabricated double thickness with trailing edge, to recommendations of SMACNA and as indicated.

## **2.5 Instrument Test**

- .1 1.6 mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.

## **2.6 Spin-In Collars**

- .1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.
- .2 Sheet metal thickness to co-responding round duct standards.

# **Part 3 Execution**

## **3.1 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

- .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 Installation**

- .1 Flexible Connections:
  - .1 Install in following locations:
    - .1 Inlets and outlets to supply air units and fans.
    - .2 Inlets and outlets of exhaust and return air fans.
    - .3 As indicated.
  - .2 Length of connection: [100] mm.
  - .3 Minimum distance between metal parts when system in operation: [75] mm.
  - .4 Install in accordance with recommendations of SMACNA.
  - .5 When fan is running:
    - .1 Ducting on sides of flexible connection to be in alignment.
    - .2 Ensure slack material in flexible connection.
- .2 Access Doors and Viewing Panels:
  - .1 Size:
    - .1 900 x 900 mm for person size entry.
    - .2 600 x 600 mm for servicing entry.
    - .3 300 x 300 mm for viewing.
    - .4 As indicated.
  - .2 Locations:
    - .1 Fire and smoke dampers.
    - .2 Control dampers.
    - .3 Devices requiring maintenance.
    - .4 Required by code.
    - .5 Reheat coils.
    - .6 Elsewhere as indicated.
- .3 Instrument Test Ports:
  - .1 General:
    - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
  - .2 Locate to permit easy manipulation of instruments.
  - .3 Install insulation port extensions as required.
  - .4 Locations:
    - .1 For traverse readings:
      - .1 Ducted inlets to roof and wall exhausters.
      - .2 Inlets and outlets of other fan systems.
      - .3 Main and sub-main ducts.
      - .4 And as indicated.
    - .2 For temperature readings:
      - .1 At outside air intakes.

- .2 In mixed air applications in locations as approved by Departmental Representative.
  - .3 At inlet and outlet of coils.
  - .4 Downstream of junctions of two converging air streams of different temperatures.
  - .5 And as indicated.
- .4 Turning Vanes:
- .1 Install in accordance with recommendations of SMACNA and as indicated.

### **3.3 Cleaning**

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

**END OF SECTION**

**Part 1 General**

**1.1 References**

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
  - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

**1.2 Action And Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for specified equipment and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 Closeout Submittals:**

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.4 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse as specified in Construction Waste Management Plan.

**Part 2 Products**

**2.1 General**

- .1 Manufacture to SMACNA standards.

**2.2 Splitter Dampers**

- .1 Fabricate from same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
- .2 Double thickness construction.
- .3 Control rod with locking device and position indicator.
- .4 Rod configuration to prevent end from entering duct.



- .5 Pivot: piano hinge.
- .6 Folded leading edge.

### **2.3 Single Blade Dampers**

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside nylon end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

### **2.4 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: 150 mm.
- .4 Maximum blade length: 1200 mm. Use multi-sectional dampers for applications exceeding 1200 mm.
- .5 Bearings: pin in bronze bushings or self-lubricating nylon.
- .6 Linkage: shaft extension to accommodate insulation thickness with locking quadrant.
- .7 Channel frame of same material as adjacent duct, complete with angle stop.
- .8 Vibration-free operation.

## **Part 3 Execution**

### **3.1 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 Installation**

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.

- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 Dampers: vibration free.
- .6 Ensure damper operators are observable and accessible.

### **3.3 Cleaning**

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

**END OF SECTION**

**Part 1 General**

**1.1 References**

- .1 Air Movement & Control Association International Inc.
  - .1 AMCA Standard 500-D, Laboratory Methods of Testing Dampers for Rating.
  - .2 AMCA Standard 511, Certified Ratings Program for Air Control Devices.
- .2 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)
  - .1 ANSI/NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
  - .2 ANSI/NFPA 80, Standard for Fire Doors and other Opening Protectives
- .3 National Fire Protection Association (NFPA)
  - .1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
- .4 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S112, Standard Test Method of Fire Test of Fire Damper Assemblies.
  - .2 CAN/ULC-S112.2, Standard Method of Fire Test of Ceiling Fire Stop Flap Assemblies.
  - .3 ULC-S505, Standard for Fusible Links for Fire Protection Service.

**1.2 Action And Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for specified equipment and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 Closeout Submittals:**

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.4 Additional Submittals**

- .1 Shop drawing submissions shall include the following additional information:
  - .1 Schedule with the following data (as applicable) for each damper:
    - .1 Type and model number.
    - .2 Installed orientation.
    - .3 Size.
    - .4 Air flow rate and pressure drop.
    - .5 Fire resistance rating.
    - .6 Closure type and temperature rating.
    - .7 Smoke damper temperature rating and leakage class.

- .2 Damper actuator details including mounting, failure position, electrical characteristics and wiring diagrams.
- .3 Accessories: including associated electrical data and wiring diagrams.
- .4 Manufacturer's installation instructions for each model.

## **1.5 Maintenance Material Submittals**

- .1 Extra Materials:
  - .1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Provide:
    - .1 6 fusible links of each type.

## **1.6 Certification Of Ratings**

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency in adherence to all codes and standards required by the authority having jurisdiction.

## **1.7 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 Fire Dampers**

- .1 Fire dampers: listed and bear label of ULC, assemblies fire tested and rated in accordance with CAN/ULC-S112, meet requirements of authorities having jurisdiction.
- .2 Classified for dynamic closure against maximum design airflow, at 2000 Pa minimum static pressure differential (across closed damper), for installed configurations and locations on systems where fan does not shut down on fire alarm.
- .3 Factory fabricated for fire resistance rating requirement and installation orientation to maintain integrity of fire wall and/or fire separation.
- .4 Curtain-type design: steel frame with reinforced corners, steel interlocking blades, sheet steel mounting sleeve (factory or field installed), transitions to suit connecting ductwork. Galvanized steel construction where connecting ductwork is galvanized, stainless steel construction where connecting ductwork is stainless steel. Provide sealed high pressure construction where duct pressure class exceeds 500 Pa or Class B or C duct seal is specified.

- .5 Closure type: fusible link actuated, weighted to close and lock in closed position when released or having stainless steel negator-type spring closing operator for damper in horizontal position with vertical air flow. Generally fusible links to be rated at 74EC for exhaust and recirculation applications, and 100EC on supply air applications. Revise, with Engineer's approval, as required to meet the needs of special locations. Fusible links shall be readily removable by hand to facilitate testing.
- .6 Damper types and transition collars to be selected based on the following criteria unless otherwise directed by the Engineer:
  - .1 Duct pressure class less than or equal to 500 Pa, unsealed or Class C duct seal, and face velocities less than or equal to 15 m/s:
    - .1 Type A: square and rectangular ductwork with air velocities less than or equal to 5 m/s and aspect ratios of 2:1 or less.
    - .2 Type B: square and rectangular ductwork with air velocities exceeding 5 m/s or aspect ratios greater than 2:1.
    - .3 Type R: round ductwork.
  - .2 Duct pressure class greater than 500 Pa, Class B duct seal, or face velocities exceeding 15 m/s:
    - .1 Type C: square and rectangular ductwork.
    - .2 Type CO: flat oval ductwork.
    - .3 Type CR: round ductwork.
- .7 Factory tested for proper operation.

## **2.2 Smoke Dampers**

- .1 Smoke dampers: listed and bear label of ULC, assemblies fire tested and rated in accordance with CAN4-S112.1, meet requirements of authorities having jurisdiction, licensed to bear the AMCA seal, assemblies tested and rated in accordance with AMCA Standards 500-D and 511.
- .2 Factory fabricated for installation orientation to maintain integrity of smoke separation.
- .3 Temperature rating: 177EC.
- .4 Leakage rating: Class I - leakage shall not exceed 40 L/s-m<sup>2</sup> at 1000 Pa minimum static pressure differential (across closed damper).
- .5 Multi-blade design: steel frame with reinforced corners and low profile head and sill, steel blades, square plated steel axles, bronze sleeve type bearings, flexible stainless steel jamb seals, pressure sensitive silicone blade edge seals, plated steel linkage concealed in frame, factory installed steel mounting sleeve, transition collars to suit connecting ductwork. Galvanized steel construction where connecting ductwork is galvanized, stainless steel construction where connecting ductwork is stainless steel. Frame leakage not to exceed that of connecting ductwork.
- .6 Blade style and operation:
  - .1 Three-V style with parallel blade operation for face velocities less than or equal to 7 m/s, two-position (fully open or fully closed) operation, and where even airflow distribution is not required downstream of open damper.
  - .2 Airfoil-shaped, double-thickness style with opposed blade operation for face velocities exceeding 7 m/s, modulating operation, ducted outlets, or upstream of system components requiring even airflow distribution.

- .7 Actuator: electric, controlled from smoke sensor or smoke detection system, spring return, fail to normally closed position, EEMAC Type 4 enclosure, factory installed on outside of damper mounting sleeve, factory wired to a single junction box for single-point wiring connection. All actuators to be provided by a single manufacturer. Confirm power supply characteristics prior to ordering.
- .8 Accessories: package for remote indication of damper position complete with switch box, two 120 V rated micro switches (one closes when the damper is fully open and the other closes when the damper is fully closed), switch box mounting bracket, blade bracket and connecting hardware.
- .9 Smoke dampers under 400 mm high shall be oversized by 50 mm (width and height) and provided with Type C enclosures with transition collars to suit connecting duct size to maximize free area.
- .10 Factory tested for proper operation.

### **2.3 Combination Fire/Smoke Dampers**

- .1 Combination fire/smoke dampers: listed and bear labels of ULC for both fire and smoke dampers, assemblies fire tested and rated in accordance with CAN/ULC-S112 and CAN/ULC-S112.1, meet requirements of authorities having jurisdiction, licensed to bear the AMCA seal, assemblies tested and rated in accordance with AMCA Standards 500-D and 511.
- .2 Damper: similar in all respects to smoke dampers specified above and incorporating required fire damper performance and rating.
- .3 Combined actuator: electric, similar in all respects to smoke dampers specified above, controlled from smoke sensor or smoke detection system and from fusible link.
- .4 Factory tested for proper operation.

### **2.4 Firestop Flaps**

- .1 Firestop flaps: listed and bear label of ULC, assemblies fire tested and rated in accordance with CAN4-S112.2, meet requirements of authorities having jurisdiction.
- .2 Factory fabricated for fire resistance rating requirement to maintain integrity of fire separation.
- .3 Galvanized steel frame and blades, non-asbestos ULC listed insulation and corrosion-resistant pins and hinges.
- .4 Flaps to be held open with fusible link conforming to ULC-S505. Generally fusible links to be rated at 74 degrees C on exhaust and recirculation air ducts, and 100 degrees C on supply air ducts. Revise, with Engineer's approval, as required to meet the needs of special locations. Fusible links shall be readily removable by hand to facilitate testing.
- .5 Factory tested for proper operation.

## **Part 3            Execution**

### **3.1               Examination**

- .1      Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
  - .1      Visually inspect substrate.
  - .2      Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3      Proceed with installation only after unacceptable conditions have been remedied.

### **3.2               Installation**

- .1      Refer to Architectural drawings for locations and ratings of fire and smoke separations. Provide dampers and firestop flaps of approved types in all duct penetrations of fire and smoke separations.
- .2      Review all damper and firestop flap locations and requirements with Engineer early in the project.
- .3      Install in accordance with ANSI/NFPA 90A, requirements of authorities having jurisdiction, and in strict accordance with conditions of ULC listing. Maintain integrity of fire and smoke separations.
- .4      Install and test in accordance with NFPA 80.
- .5      Install break-away joints of approved design on each side of fire separation unless otherwise directed by Engineer.
- .6      Coordinate with TAB contractor early in the project. Review locations and access requirements of all dampers and firestop flaps to facilitate testing.
- .7      After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .8      Provide access door adjacent to each damper.
- .9      Coordinate with installer of firestopping. Any firestopping required by local codes or authorities having jurisdiction shall be done in strict accordance with conditions of ULC listing using approved materials. Fire stop in accordance with manufacturer's installation instructions.
- .10     Ensure access doors/panels, fusible links, damper operators are easily observed and accessible for inspection, testing and replacement.
- .11     Identify all dampers and firestop flaps clearly and accurately on project record drawings.

### **3.3               Testing**

- .1      Test for proper operation of all smoke and fire dampers, sensors, detectors, [ ] installed as component parts of air systems specified Division 23.
- .2      Test each fire damper by releasing it twice so as to check whether the damper is binding and is operating in accordance with requirements of the authority having jurisdiction. Reset dampers in accordance with manufacture's directions. Resolve all problems and then re-test, until satisfactory result is achieved. Permanently mark all

dampers with an identification number which shall also appear on the "as-built" drawings. Submit a test report to the Engineer, listing the following data:

- .1 Identification of each fire damper corresponding with the "as-built" drawings.
  - .2 Test results of each damper, including access problems.
  - .3 Repair procedures, if any, to each damper if not properly working.
  - .4 State the date of the check(s).
  - .5 Name of company and checker(s).
- .3 Affix tag to duct adjacent fire and smoke dampers indicating date of test, TAB company name and contact info, technician initials.
  - .4 Include a complete copy of the written report in each Operating/Maintenance Manual.
  - .5 Confirm closure of smoke and combination fire/smoke dampers on during fire alarm condition and power failure.
  - .6 Confirm proper operation of smoke dampers and combination fire smoke dampers according to specified sequences of operation, including manual overrides and safeties.

### **3.4 Cleaning**

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

**END OF SECTION**



**Part 1 General**

**1.1 References**

- .1 Air Diffusion Council (ADC).
  - .1 Flexible Duct Performance & Installation Standards.
- .2 American Society for Testing and Materials International (ASTM).
  - .1 ASTM C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- .3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
- .4 National Fire Protection Association (NFPA)
  - .1 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.
  - .2 NFPA 90B, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.
- .5 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA)
  - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible.
  - .2 SMACNA IAQ Guideline for Occupied Buildings under Construction.
- .6 Underwriters' Laboratories (UL)
  - .1 UL 181, Standard for Factory-Made Air Ducts and Air Connectors.
- .7 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S110, Standard Methods of Tests for Air Ducts.

**1.2 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for flexible ducts and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate:
    - .1 Thermal properties.
    - .2 Friction loss.
    - .3 Acoustical loss.
    - .4 Leakage.
    - .5 Fire rating.
- .3 Test and Evaluation Reports:
  - .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

### **1.3 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 General**

- .1 Factory fabricated Class 1 flexible air ducts conforming to the requirements UL 181 and CAN/ULC-S110.
- .2 Joint mastics and tapes: listed and labelled in accordance with UL 181B and complying with CAN/ULC-S110.
- .3 Duct clamps: stainless steel construction with worm gear operators.
- .4 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
- .5 Flame spread rating not to exceed 25. Smoke developed classification not to exceed 50.
- .6 Thermal resistance properties determined in accordance with ADC Flexible Duct Performance & Installation Standards using ASTM C518. Products shall bear the ADC Seal of Certification.

### **2.2 Non-Metallic – Uninsulated**

- .1 Type NM-UN: non-collapsible, heavy duty vinyl-impregnated woven fibreglass cloth permanently bonded to, and supported by, corrosion resistant spring steel wire helix.
- .2 Performance:
  - .1 Factory tested to 2.5 kPa without leakage.
  - .2 Operating static pressure limits: 2.5 kPa positive, 0.25 kPa negative.
  - .3 Maximum relative pressure drop coefficient: 2.

### **2.3 Non-Metallic – Insulated (Lined)**

- .1 Type NM-IL: non-collapsible, chlorinated polyethylene core (CPE) core permanently bonded to, and supported by, corrosion resistant spring steel wire helix with factory applied flexible mineral fibre acoustic insulation and encased in metallized polyester film (MPF) vapour barrier jacket reinforced with fibreglass scrim.
- .2 Performance:
  - .1 Factory tested to 2.5 kPa without leakage.
  - .2 Operating static pressure limits: 2.5 kPa positive, 0.25 kPa negative.
  - .3 Maximum relative pressure drop coefficient: 2.

- .4 Thermal resistance: 0.74 W/m<sup>2</sup>-degrees C mean.
- .5 Acoustical performance: Minimum insertion loss (dB/m of straight duct @ no flow) to following table:

Duct Diam:	Frequency (Hz)				
(mm)	125	250	500	1000	2000
150	4.9	6.6	11.8	12.8	12.8
200	2.6	3.9	9.5	11.5	11.8
300	6.6	8.5	8.5	11.5	9.8

### **Part 3 Execution**

#### **3.1 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

#### **3.2 Proceed With Installation Only After Unacceptable Conditions Have Been Remedieduct Installation**

- .1 Install in accordance with SMACNA and ADC standards.
- .2 Joints shall be made up using mastic and duct clamps. Insulation and vapour barrier on type NM-IL flexible ducts shall be secured with a combination of tape and duct clamps.
- .3 Use to accommodate misalignment of branch ducts and diffusers. Provide type NM-IL flexible duct where connecting rigid duct is insulated internally or externally. Provide type NM-UN flexible duct where connecting rigid duct is not insulated.
- .4 Maximum length at each diffuser: 1,000 mm.
- .5 Maximum turn allowed: 30°. Otherwise use a rigid elbow.

#### **3.3 Cleaning**

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

**END OF SECTION**

**Part 1 General**

**1.1 References**

- .1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
  - .1 ANSI/AMCA Standard 99, Standards Handbook.
  - .2 ANSI/AMCA Standard 210/(ANSI/ASHRAE 51-07), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
  - .3 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans.
  - .4 ANSI/AMCA Standard 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

**1.2 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for HVAC fans and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Provide:
    - .1 Fan performance curves showing point of operation, bhp and efficiency.
    - .2 Sound rating data at point of operation.
  - .2 Indicate:
    - .1 Motors, sheaves, bearings, shaft details.
    - .2 Minimum performance achievable with variable speed controllers where applicable.

**1.3 Maintenance Material Submittals**

- .1 Extra Materials:
  - .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
    - .1 Provide:
      - .1 Matched sets of belts.
      - .2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:
        - .1 Bearings and seals.
        - .2 Addresses of suppliers.
        - .3 List of specialized tools necessary for adjusting, repairing or replacing.

## **1.4 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse as specified in Construction Waste Management Plan.

## **Part 2 Products**

### **2.1 System Description**

- .1 Performance Requirements:
  - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
  - .2 Capacity: flow rate, static pressure, bhp, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
  - .3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99.
  - .4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300.
  - .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210.

### **2.2 Fans General**

- .1 Motors:
  - .1 For use with variable speed controllers.
  - .2 Sizes as indicated in schedules.
- .2 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

### **2.3 Direct Drive Premium Ceiling Mounted Centrifugal Exhaust Fans**

- .1 General Description:
  - .1 Ceiling mounted applications
  - .2 Maximum operating temperature is 130 Fahrenheit (54.4 Celsius)
  - .3 Fans are UL/cUL listed 507 - Electric Fans
  - .4 Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number

- .2 Wheel:
  - .1 Forward curved centrifugal wheel
  - .2 Constructed of galvanized steel or calcium carbonate filled polypropylene
  - .3 Statically and dynamically balanced in accordance to AMCA Standard 204-05
- .3 Motors:
  - .1 AC Induction Motor
  - .2 Motor enclosures: Open drip proof (ODP) - opening in the frame body and or end brackets
  - .3 Motors shall be permanently lubricated sleeve bearing type to match with the fan load and furnished at the specific voltage and phase.
  - .4 Motor shall be mounted on vibration isolators and be accessible for maintenance
  - .5 Thermal overload Protection
- .4 Housing:
  - .1 Constructed of heavy gauge galvanized steel
  - .2 Interior shall be lined with 0.5 inches of acoustical insulation
  - .3 Profile as low as 10 1/2 inches
- .5 Spring Loaded Aluminum Backdraft Damper:
  - .1 Prevents air from entering back into the building when fan is off
  - .2 Eliminates rattling or unwanted backdrafts
- .6 Outlet:
  - .1 Type of outlet: Square
  - .2 Field rotatable from horizontal to vertical discharge
  - .3 Shall include an aluminum backdraft damper
- .7 Grille:
  - .1 Type: Decorative - Calcium-carbonate, Lighted and non-lighted
  - .2 Constructed of high impact polystyrene, plastic shall be factory standard
- .8 External Electrical Accessories:
  - .1 Eliminates removing the motor pack which saves time on installation
- .9 Mounting Brackets:
  - .1 Fully adjustable for multiple installation conditions

## **2.4 Direct Drive Premium Inline Cabinet Centrifugal Exhaust Fans**

- .1 General Description:
  - .1 Inline mounted applications
  - .2 Maximum operating temperature is 130 Fahrenheit (54.4 Celsius)
  - .3 Fans are UL/cUL listed 507 - Electric Fans
  - .4 Each fan shall bear a permanently affixed manufacture's nameplate containing the model number and individual serial number

- .2 Wheel:
  - .1 Forward curved centrifugal wheel
  - .2 Constructed of galvanized steel or calcium carbonate filled polypropylene
  - .3 Statically and dynamically balanced in accordance to AMCA Standard 204-05
- .3 Motors:
  - .1 AC Induction Motor
    - .1 Motor enclosures: Open drip proof (ODP) - opening in the frame body and or end brackets
    - .2 Motors shall be permanently lubricated sleeve bearing type to match with the fan load and furnished at the specific voltage and phase.
    - .3 Motor shall be mounted on vibration isolators and be accessible for maintenance
    - .4 Compatible for use with speed controls
    - .5 Thermal overload Protection
- .4 Housing:
  - .1 Constructed of heavy gauge galvanized steel
  - .2 Interior shall be lined with 0.5 inches of acoustical insulation
- .5 Spring Loaded Aluminum Backdraft Damper:
  - .1 Prevents air from entering back into the building when fan is off
  - .2 Eliminates rattling or unwanted backdrafts
- .6 Outlet:
  - .1 Type of outlet: Square
  - .2 Field rotatable from horizontal to vertical discharge
  - .3 Shall include an aluminum backdraft damper
- .7 External Electrical Accessories:
  - .1 Eliminates removing the motor pack which saves time on installation
- .8 Mounting Brackets:
  - .1 Fully adjustable for multiple installation conditions
- .9 Access Panel:
  - .1 Once installed shall have easy access to internal components

## **Part 3 Execution**

### **3.1 Examination**

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

- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 Fan Installation**

- .1 Install fans as indicated.
- .2 Provide sheaves and belts required for final air balance.
- .3 Bearings and extension tubes to be easily accessible.
- .4 Access doors and access panels to be easily accessible.

### **3.3 Anchor Bolts And Templates**

- .1 Size anchor bolts to withstand and velocity forces anticipated

### **3.4 Cleaning**

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

**END OF SECTION**



**Part 1 General**

**1.1 References**

- .1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
  - .1 ANSI/AMCA Standard 210/(ANSI/ASHRAE 51), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .2 International Organization of Standardization (ISO)
  - .1 ISO 3741, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Methods for Reverberation Rooms.
- .3 National Fire Protection Association (NFPA)
  - .1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
- .4 Underwriter's Laboratories (UL)
  - .1 UL 181, Factory-Made Air Ducts and Air Connectors.

**1.2 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for air terminal units and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate the following:
    - .1 Capacity.
    - .2 Pressure drop.
    - .3 Noise rating.
    - .4 Leakage.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Test and Evaluation Reports:
  - .1 Test data: to ANSI/AMCA Standard 210
    - .1 Submit published test data on DIN (Direct Internal Noise), in accordance with ISO 3741 made by independent testing agency for 0, 2.5 and 6 m/s branch velocity or inlet velocity.
    - .2 Sound power level with minimum inlet pressure of 0.25 kPa in accordance with ISO 3741 for 2nd through 7th octave band, also made by independent testing agency.
    - .3 Pressure loss through silencer shall not exceed 60% of inlet velocity pressure maximum.

**1.3 Closeout Submittals:**

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

**1.4 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 System Description**

- .1 Performance Requirements:
  - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from certified ADC (Air Diffusion Council) testing agency signifying adherence to codes and standards.

**2.2 Manufactured Units**

- .1 Terminal units of the same type to be product of one manufacturer.

**2.3 Single Duct Variable Air Volume Terminal Units**

- .1 Pressure independent and shall reset to any airflow rate between zero and the maximum catalogued airflow rate.
- .2 At an inlet air velocity of 10 m/s, the static pressure drop across any unit with attenuator section shall not to exceed 37 Pa.
- .3 Casing: constructed of 0.85 mm thick galvanized steel with inlet connection bead and outlet with slip and drive connections. Internally lined with 13 mm, 0.7 kg density matt-faced fibreglass insulation that complies with UL181 and ANSI/NFPA 90A. All insulation edges exposed to the air stream shall be coated with NFPA 90A approved sealant. Suitable for inlet static pressures up to 1500 Pa. Casing air leakage rates shall not exceed the values listed in the following table:

Unit Size:	Maximum Casing Leakage (L/s) at Listed Static Pressure				
	62 Pa	125 Pa	250 Pa	750 Pa	1500 Pa
5, 6	0.5	0.9	1.4	3.3	4.7
7, 8	0.5	0.9	1.4	3.3	4.7
9, 10	0.5	0.9	1.4	3.3	4.7
12	0.5	0.9	1.4	3.3	5.7

- .4 Primary air valve damper: heavy gauge galvanized steel with peripheral gasket, solid steel shaft and self-lubricating bearings. Air leakage past closed damper shall not exceed 2% of nominal catalogue rating at 750 Pa inlet static pressure, when tested in accordance with ANSI/ASHRAE 130.
- .5 Airflow sensor: aerodynamic cross configuration located the assembly inlet to traverse the duct using the equal cross sectional area or log-linear traverse method along two perpendicular diameters. The sensor shall have a minimum of 12 total pressure sensing ports, 4 static pressure sensing ports, center averaging chamber and gauge taps. Sensor accuracy shall be within 5% of rated airflow with a 90° sheet metal elbow located directly at the inlet of the assembly. The sensor shall output an amplified differential pressure signal of 7.5 Pa at assembly air inlet velocities < 2.3 m/s. Output differential signals shall fall within the standard 0 - 250 Pa range of most transducers and flow controllers.
- .6 Controls: damper actuator, A/D transducer and DDC controller to be supplied by the Controls Subcontractor to the terminal unit manufacturer for installation. All controls components shall be factory mounted, wired and calibrated per the controls contractor's documentation. All control components shall be located inside a protective metal enclosure provided by the terminal unit manufacturer; refer to drawings for enclosure location. Compatibility of the proposed A/D transducer and DDC controller with the airflow sensor shall be verified by the Controls Subcontractor prior to bidding the Project.
  - .1 Tie into existing building controls system. Integrate operation with perimeter heaters. Sequence of operations to match existing VAV boxes in building.
- .7 Sound attenuators: integral extension of the unit casing or a separate section with slip and drive connections. Construction and internal lining as per unit casing. Length and outlet arrangement as scheduled and indicated on the drawings.

### **Part 3 Execution**

#### **3.1 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

#### **3.2 Installation**

- .1 Install in accordance with manufacturers recommendations.
- .2 Support independently of ductwork.
- .3 Install with at least 1000 mm of flexible inlet ducting and minimum of four duct diameters of straight inlet duct, same size as inlet.
- .4 Locate controls, dampers and access panels for easy access.

### **3.3           Cleaning**

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

**END OF SECTION**

**Part 1 General**

**1.1 References**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
  - .1 ASHRAE Standard 70, Method of Testing for Rating the Performance of Air Outlets and Inlets

**1.2 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for diffusers, registers and grilles and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Indicate following:
    - .1 Capacity.
    - .2 Throw and terminal velocity.
    - .3 Noise criteria.
    - .4 Pressure drop.
    - .5 Neck velocity.

**1.3 Maintenance Material Submittals**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
  - .2 Include:
    - .1 Keys for volume control adjustment.
    - .2 Keys for air flow pattern adjustment.

**1.4 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 System Description**

- .1 Performance Requirements:
  - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

**2.2 General**

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
  - .1 Full perimeter gaskets.
  - .2 Plaster frames where set into plaster or gypsum board.
  - .3 Concealed fasteners.
- .3 Concealed manual volume control damper operators.
- .4 Colour: as per schedule.

**2.3 Manufactured Units**

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

**2.4 Diffusers, Grilles And Registers**

- .1 Refer to schedule.
- .2 General requirements:
  - .1 To meet the features, capacity, pressure drop, terminal velocity, throw, noise level, and neck velocity of the scheduled product.
  - .2 Frames:
    - .1 Appropriate to surrounding construction material.
    - .2 Plaster frames where set into plaster or gypsum board and where otherwise specified.
    - .3 Full perimeter gaskets.
    - .4 Concealed fasteners.
  - .3 Concealed manual volume control damper operators.
  - .4 Flow Equalizing Grids: provide in the neck of all ceiling diffusers.
  - .5 Colour: baked off-white epoxy enamel unless otherwise directed by the Engineer.
  - .6 Grilles, registers and diffusers of same generic type to be the product of one manufacturer.
- .3 Features and performance: as scheduled. Scheduled characteristics govern where they conflict with the general requirements herein.

**Part 3 Execution**

**3.1 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

**3.2 Installation**

- .1 Install in accordance with manufacturer's instructions.
- .2 Install with] screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.
- .4 Provide concealed safety chain on each grille, register and diffuser in gymnasium and similar game rooms.

**3.3 Cleaning**

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

**END OF SECTION**

**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

- .1 Definitions:
  - .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.
- .2 Reference Standards:
  - .1 CSA Group
    - .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
    - .2 CAN3-C235-[83(R2010)], Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
  - .2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
    - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

**1.3 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit for review fire alarm riser diagram, plan and zoning of building under plexiglass at fire alarm control panel and annunciator.
- .4 Shop drawings:
  - .1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
  - .2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
  - .3 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.
  - .4 If changes are required, notify Departmental Representative of these changes before they are made.
- .5 Certificates:



- .1 Provide CSA certified equipment and material.
- .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.
- .3 Submit test results of installed electrical systems and instrumentation.
- .4 Permits and fees: in accordance with General Conditions of contract.
- .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
- .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .6 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.
- .7 Sustainable Design Submittals:

#### **1.4 Closeout Submittals**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
  - .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
  - .2 Operating instructions to include following:
    - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
    - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
    - .3 Safety precautions.
    - .4 Procedures to be followed in event of equipment failure.
    - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
  - .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
  - .4 Post instructions where directed.
  - .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
  - .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

#### **1.5 Delivery, Storage And Handling**

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

- .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect all materials and equipment from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 Design Requirements**

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates for control items in English.
- .4 Use one nameplate for each language.

### **2.2 Materials And Equipment**

- .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

### **2.3 Electric Motors, Equipment And Controls**

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

### **2.4 Warning Signs**

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction and Departmental Representative.
- .2 Decal signs, minimum size 175 x 250 mm.

### **2.5 Wiring Terminations**

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

### **2.6 Equipment Identification**

- .1 Identify electrical equipment with nameplates as follows:

- .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black face, white core, lettering accurately aligned and engraved into core and mechanically attached with self tapping screws.

- .2 Sizes as follows:

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

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved as directed by Departmental Representative.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.

## 2.7 Wiring Identification

- .1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

## 2.8 Conduit And Cable Identification

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	

Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

## **2.9 Finishes**

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

## **Part 3 Execution**

### **3.1 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 Installation**

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

### **3.3 Nameplates And Labels**

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

### **3.4 Conduit And Cable Installation**

- .1 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .2 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

### **3.5 Location Of Outlets**

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
  - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

### **3.6 Mounting Heights**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1050 mm.
  - .2 Wall receptacles:
    - .1 General: 400 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: 1400 mm.
  - .3 Panelboards: as required by Code or as indicated.
  - .4 Fire alarm stations: 1050 mm.

### **3.7 Field Quality Control**

- .1 Load Balance:
  - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
  - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
  - .3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
  - .1 Circuits originating from branch distribution panels.
  - .2 Lighting and its control.
  - .3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
  - .4 Systems: fire alarm.
  - .5 Insulation resistance testing:
    - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
    - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

- .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Departmental Representative.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### **3.8 System Startup**

- .1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

### **3.9 Cleaning**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

**Part 1 General**

**1.1 Related Work**

- .1 Refer to all sections of the specification for related work.

**1.2 Coordination**

- .1 The existing Building shall remain open and remain in normal operation during entire construction period.
- .2 Contractor shall allow for off-hours work as required.
- .3 Where existing services or systems, such as electrical power, telephone system, data systems, equipment alarm system, fire alarm system, etc. are required to be disrupted and/or shut-down, coordinate the shut-downs with the Departmental Representative and carry out the work at a time and in a manner acceptable to them. Carefully schedule all disruptions and/or shutdowns and ensure the duration of same is kept to the absolute minimum. Submit for approval, a written concise schedule of each disruption at least 120 hours in advance of performing work and obtain written consent prior to implementing.
- .4 Should any temporary connections be required to maintain services or systems during work in the existing building, supply and install all necessary material and equipment and provide all labour at no extra cost. Should any existing equipment or system be damaged, make full repairs without extra cost, and to the satisfaction of the Owner and Consultant.
- .5 Refer to Division 01 - General Requirements for phasing and staging of work and adhere to that schedule. Comply with instructions regarding working hours necessary to maintain the building in operation.

**1.3 Existing Devices In New Construction**

- .1 Disconnect and remove existing electrical equipment made obsolete due to renovations. Remove associated wiring and conduits back to source panel.
- .2 Where existing devices (receptacles, switches, etc.) are presently mounted on a wall which will be covered with a new finish, provide an extension ring, coverplate, etc., as required, to mount device to new wall finish.
- .3 All existing electrical equipment to remain, which is located in or on portions of existing walls being demolished, shall be relocated to nearest wall. This equipment shall include cabinets, panels, switches, receptacles, etc.
- .4 Where existing conduits, which are in use, pass vertically through a wall being demolished, relocate those conduits and conceal in a new wall or surface mount in a service area. Extend conduit, wiring, etc. as required.
- .5 Where new ceilings are to be installed, relocate all existing ceiling mounted devices down to new ceiling. This equipment shall include but not be limited to smoke

detectors, heat detectors, speakers, luminaires, etc. Extend existing conduit and wiring as required.

- .6 All existing junction boxes in walls and ceiling spaces required to maintain existing circuits shall remain accessible.
- .7 Include all costs to x-ray existing floors to be drilled or sleeved to ensure no existing services are severed or damaged. Damages could be very serious. Any damages resulting from failure to x-ray (or scan) is the Contractor's responsibility.
- .8 Redundant existing circuit breakers shall be left and labelled as spares, left on off position and no wiring attached to it.
- .9 Field-check all existing systems including fire alarm work on site including existing terminal boxes on each floor before submitting tender. Include all required work and re-work as may be required for a completely finished working system. No compensation will be given to the Contractors for work that should have been foreseen before submitting tenders.

#### **1.4 Demolition**

- .1 Include all costs as per the following items:
  - .1 Demolition, relocation and/or re-routing of electrical and telecom services as required when renovating the building.
  - .2 Permits and costs of subcontractors involved in renovation work.
  - .3 Installation, removal and re-installation of all electrical and telecom temporary services as per utilities requirements and/or architectural phase work.
  - .4 Electrical contractor must inspect and budget for demolition work.
- .2 Electrical work for this phase of the project includes the demolition of all electrical systems within the area of demolition, including but not limited to:
  - .1 Lighting & emergency lighting and lighting controls
  - .2 Normal and emergency power distribution and outlets
  - .3 Fire alarm
  - .4 Security (sensors, alarms)
  - .5 Voice/data
  - .6 Public address/intercom
  - .7 Exit signs
  - .8 Access control (mag locks, electric strikes, card readers)
  - .9 Connections to mechanical equipment.
  - .10 Connections to owner's equipment
- .3 Maintain integrity of all existing electrical systems in spaces outside demolition area and perimeter walls. All safety systems inside and outside of demolition area are to maintain integrity during the entire demolition phase of the project.
- .4 Label wiring, conduit, breakers, junction boxes, etc. for maintained systems.
- .5 Provide as-built drawings for maintained systems. Update record drawings.



- .6 Building to remain in normal operation during electrical demolition. Electrical work shall not accidentally disrupt systems in other areas of the building. Any disruptions of power/fire alarm/lighting, etc. must be scheduled with Departmental Representative and other trades involved prior to commencing of work. Contact Facilities Manager for standard hours minimum notice for all shutdowns.
- .7 Electrical certified team to survey all electrical circuits prior to commencement of electrical work to prevent any service disruption in other areas of the building.
- .8 A qualified journeyman electrician team must be assigned to identify, classify, codify and tag all electrical equipment and devices within the demolition area.
- .9 Classification and tagging of all equipment and devices should follow a coordinated mechanical and electrical colour code: (Tags should be attached securely to equipment/device to avoid any loss of information)
- .10 Report to construction manager once all tagging has been determined, installed and verified to obtain approval with owner prior to commencement of work. Any/all questions must be answered and confirmed to clear all red tags (unknowns) prior to work proceeding.
- .11 Electrical contractor to be responsible for removal and return of all electrical devices and wiring affected within limits of demolition areas.
  - .1 Patching, Cutting and Sealing
    - .1 Provide sealing and patching for all existing walls/floor/ceiling affected by removal of any raceways or conduits. All fire walls to be sealed with CSA approved fire rated material for fire separation. Approved caulking is to be used in construction walls.
  - .2 Receptacles
    - .1 All existing receptacles and direct connections feeding existing loads located within area of demolition not being reused are to be disconnected and removed. All associated wiring is to be removed back to the source.
    - .2 Any receptacles located outside of the area of demolition and connected to the circuits originating in the area of demolition are to be reconnected to nearest available circuits originating at corresponding panels outside of the area of demolition.
    - .3 Clearly mark and update panelboard directories.
  - .3 Wiring of Mechanical and services Equipment
    - .1 Disconnect mechanical services equipment associated with the area of demolition, as indicated elsewhere in this specification or on drawings. Remove all associated wiring, disconnect switches, motor starters and motor controls. Maintain integrity of electrical installation associated with all equipment being reused.
    - .2 Mechanical equipment located outside of the area of demolition and receiving power from within the area of demolition is to be re-fed temporarily or permanently from nearest available panels located outside of the area of demolition.
  - .4 Fire Alarm System

- .1 The fire alarm system is to remain operational at all times. Interruptions for the purpose of circuit modification are to be minimized and coordinated with Departmental Representative in advance. Provide a manufacturer verification inspection report upon completion of all deletions and modifications to the system.
- .2 Manual pull stations are to remain at means of egress only. Relocate and/or add manual pull stations to accommodate new exiting configuration. Extend existing wiring. Remove existing pull stations no longer associated with existing means of egress.
- .3 Fire alarm audible devices in the area of demolition are to remain. Provide temporary support if required.
- .4 Devices located within the area of demolition are to be connected to separate zones from the remainder of the building. Modify existing wiring and panels to accommodate provision of separate fire alarm zoning for the area of demolition.
- .5 Exit Signage
  - .1 Provide exit signs at all means of egress from the area of demolition. Existing exit signs which are functional and in good condition are to be reused. Provide temporary support if needed. Exit signs are to be wired to an existing circuit feeding exit signage outside of the area of demolition.
  - .2 All indicated exit signs and associated wiring and conduit to be removed or relocated.
- .6 Lighting and Switching
  - .1 All existing to be demolished luminaires and ballasts in the area of demolition are to be removed, cleaned and turned over to the Owner at a specified location, with exception of those used for temporary lighting. Existing light controls in the area of demolition are to be removed. Existing wiring associated with the lighting in the area of demolition is to be removed back to the source.
  - .2 If necessary, provide temporary lighting in the area of demolition consisting of two and/or 4-lamp fluorescent luminaires spaced to meet code: Utilize existing luminaires that are in good working condition. Inspect existing luminaires to be re-used. Clean, relamp and re-ballast existing luminaires as required. Wire luminaires, spaced evenly throughout the area to a 15A-1P circuit breaker in the nearest available power panel located outside of the area of demolition. These luminaires are to be unswitched and to provide emergency and night lighting. The balance of the temporary lighting luminaires is to be connected to 15A-1P circuit breakers in the nearest available non-essential power panel located outside of the area of demolition. These luminaires are to be controlled by wall mounted switches located at an entrance door into each area as directed on site.
  - .3 Construction manager is to report any ballasts containing PCB or environmentally hazardous materials and contact project Owner's Representative for proper disposal.
- .7 Voice and Data Communication Systems
  - .1 All voice and data outlets in the area of demolition and associated conduit and wiring are to be removed. The removal of such outlets

and wiring shall not affect the operation of the corresponding systems outside of the area of demolition.

- .2 Provide temporary telephone line(s) as required. Verify exact location on site.

.8 Access, Security, and other Alarms and Controls

- .1 All access control, security, and other alarms and controls in the area of demolition and associated wiring and conduit are to be removed where indicated. The removal of these equipment and wiring shall not affect the operation of the corresponding systems outside of the area of demolition. Any disruptions to operation of existing systems outside of the area of demolition are to be minimized and coordinated with Departmental Representative in advance.

.9 Power Distribution

- .1 Existing panels and other distribution equipment in the area of demolition are to be disconnected and removed if indicated. The existing associated wiring is to be pulled back to the source and removed. All existing circuits feeding devices/outlets outside of the area of demolition are to be re-routed and/or transferred to the nearest available panels in the corresponding areas.
- .2 Any power interruptions to the areas other than the area of demolition are to be minimized, are to occur outside of normal working hours of the facility, and are to be coordinated with Departmental Representative in advance.
- .3 Update panelboard directories in all CDP's and panelboards. All unused circuit breakers are to remain in panelboards.

**1.5 Relocate Existing Cabling And Devices In New Construction**

- .1 Include allowance to relocate existing cabling that may exist in ceiling spaces. Allow to include replacing of devices and entire lengths of cables, testing and commissioning.

**1.6 Schedule Of Work**

- .1 Carefully note and refer to Division 01 Section 01 11 00 Summary of Work for general schedule of work and include for all requirements to conform to it.

**Part 2 Products**

**2.1 Materials**

- .1 Provide all materials required for the complete interface and reconnection installation as herein described and as indicated on the drawings.
- .2 New wiring required to interconnect new devices to existing systems shall be provided to suit the manufacturer's requirements and instructions.
- .3 Add new grounding materials as required to make existing grounding systems good.

- .4 Add modules, switches, etc., in existing control panels, as required, to extend existing systems to the new or renovated areas.

**Part 3 Execution**

**3.1 Installation**

- .1 Install boxes, conduit and wiring through existing areas as required for the new installation.
- .2 Patch and repair floors, walls and ceilings in existing building that have been damaged or cut open due to the new electrical installation.
- .3 Patch, paint to match surface color and make good existing walls which are to remain where existing electrical devices have been removed.
- .4 Where new cables or conduits have been installed through existing fire rated walls, seal opening around cables and conduit to maintain fire rating. Refer to Section 07 84 00, Fire Stopping Section.
- .5 Test and confirm all existing grounding systems are effective and in good condition. Include work and materials required to change wiring and make good existing.

END OF SECTION

**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

- .1 CSA International
  - .1 CAN/CSA-C22.2 No.18-[98(R2003)], Outlet Boxes, Conduit Boxes and Fittings.
  - .2 CAN/CSA-C22.2 No.65-[03(R2008)], Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
  - .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

**1.3 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4 Closeout Submittals**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

**1.5 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 Materials**

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to NEMA to consist of:
  - .1 Connector body and stud clamp for stranded copper conductors.
  - .2 Clamp for stranded copper conductors.
  - .3 Stud clamp bolts.
- .4 Clamps or connectors for armoured cable, TECK cable as required to: CAN/CSA-C22.2 No.18.

## **Part 3 Execution**

### **3.1 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 Installation**

- .1 Remove insulation carefully from ends of conductors cables and:
  - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
  - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
  - .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
  - .4 Install bushing stud connectors in accordance with NEMA.

### **3.3 Cleaning**

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

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

**END OF SECTION**

**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

- .1 Not used.

**1.3 Product Data**

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

**1.4 Delivery, Storage And Handling**

- .1 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 Building Wires**

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE Jacketted.
- .3 Neutral supported cable: 1 phase insulated conductors of Copper and one neutral conductor of Copper steel reinforced, size as indicated. Type: NS90 Insulation: Type NS-1 rated 300 V.

**2.2 Teck 90 Cable**

- .1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Conductors:
  - .1 Grounding conductor: copper.
  - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
  - .1 Ethylene propylene rubber EP.
  - .2 Cross-linked polyethylene XLPE.
  - .3 Rating: 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking galvanized steel.
- .6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.
- .7 Fastenings:



- .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
- .2 Channel type supports for two or more cables at 1500 mm centers.
- .3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
  - .1 Watertight, approved for TECK cable.

## **2.3 Armoured Cables**

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90. Should be limited to lighting drops and running down walls for plugs. And for set distance of 3m max.
- .3 Armour: interlocking type fabricated from galvanized steel strip.
- .4 Connectors: anti short connectors.

## **Part 3 Execution**

### **3.1 Field Quality Control**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

### **3.2 General Cable Installation**

- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .6 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

### **3.3 Installation Of Building Wires**

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
  - .2 In surface and lighting fixture raceways in accordance with Section 26 05 00 and section 26 05 33..

**3.4 Installation Of Teck90 Cable (0 -1000 V)**

- .1 Group cables wherever possible on channels.
- .2 Install cable concealed, securely supported by straps.

**3.5 Installation Of Armoured Cables**

- .1 Group cables wherever possible on channels.

**END OF SECTION**

**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

- .1 CSA Group
  - .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
  - .2 CSA C22.2 No.41-13, Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).
  - .3 CSA C22.2 No.65-13, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

**1.3 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for connectors and terminations and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates: obtain inspection certificate of compliance covering high voltage stress from inspection authority and include it with maintenance manuals.

**1.4 Closeout Submittals**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for connectors and terminations for incorporation into manual.

**1.5 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect connectors and terminations from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 Connectors And Terminations**

- .1 Copper long barrel compression connectors to CSA C22.2 No.65 as required sized for conductors.
- .2 Contact aid for aluminum cables where applicable.
- .3 2 way joint boxes dry location type in accordance with Section 26 05 33 - Raceway and Boxes for Electrical Systems.

**Part 3 Execution**

**3.1 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for connectors and terminations installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 Installation**

- .1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2 No.41.

**3.3 Cleaning**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

- .1 C22.1-15, Section 10- Equipment Grounding and Bonding.
- .2 C22.2 No. 41-13 - Grounding and Bonding Equipment.

**Part 2 Products**

**Part 3 Execution**

**3.1 Equipment Grounding**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, mechanical equipment, outlet boxes, electrical panel, access control panel, intrusion panel, lighting fixture metallic enclosures, cable trays.

**3.2 Field Quality Control**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

**3.3 Cleaning**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

**1.3 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors,] in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect hangers and supports from nicks, scratches, and blemishes].
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 Support Channels**

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, suspended.

**Part 3 Execution**

**3.1 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hangers and supports installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

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

## **3.2 Installation**

- .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.
  - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
  - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
  - .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems.
  - .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
  - .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

### **3.3           Cleaning**

- .1       Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1       Leave Work area clean at end of each day.
- .2       Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**



**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26,27 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

**1.3 Action And Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

**Part 2 Products**

**2.1 Splitters**

- .1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Terminations: main and branch lugs connection blocks to match required size and number of incoming and outgoing conductors as indicated.
- .3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

**2.2 Junction And Pull Boxes**

- .1 Construction: welded steel enclosure.
- .2 Covers Flush Mounted: 25 mm minimum extension all around.
- .3 Covers Surface Mounted: screw-on turned edge covers.

**2.3 Cabinets**

- .1 Construction: welded sheet steel hinged door, handle, latch, lock 2 keys and catch
- .2 Type E Empty: surface return flange mounting.
- .3 Type T Terminal: flush overlapping sides mounting containing sheet steel 19 mm G1S fir plywood backboard.

**Part 3            Execution****3.1                Splitter Installation**

- .1        Mount plumb, true and square to building lines.
- .2        Extend splitters full length of equipment arrangement except where indicated otherwise.

**3.2                Junction, Pull Boxes And Cabinets Installation**

- .1        Install pull boxes in inconspicuous but accessible locations.
- .2        Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3        Install terminal block as indicated in Type T cabinets.
- .4        Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

**3.3                Identification**

- .1        Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.
- .2        Identification Labels: size 2 indicating system name voltage and phase or as indicated.

**END OF SECTION**

**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

**1.3 Action And Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit samples for floor box in accordance with Section 01 33 00 - Submittal Procedures.

**1.4 Delivery, Storage And Handling**

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

**Part 2 Products**

**2.1 Outlet And Conduit Boxes General**

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

**2.2 Galvanized Steel Outlet Boxes**

- .1 One-piece electro-galvanized construction.
- .2 Single gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .5 Extension and plaster rings for flush mounting devices in finished plaster walls.

## **2.3 Floor Boxes**

- .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: 73 mm for receptacles and communication outlets.
- .2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 27 mm conduit. Minimum size: 73 mm deep.

## **2.4 Conduit Boxes**

- .1 Cast FS boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

## **2.5 Fittings - General**

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to [35]mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

## **Part 3 Execution**

### **3.1 Installation**

- .1 Support boxes independently of connecting conduits.
- .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 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

**END OF SECTION**

**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28.

**1.2 References**

- .1 CSA International
  - .1 CSA C22.2 No.40, Cutout, Junction and Pull Boxes.

**1.3 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

**1.4 Closeout Submittals**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for raceway and boxes for incorporation into manual.

**1.5 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location] and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan

**Part 2 Products****2.1 Junction Boxes**

- .1 Junction boxes cast iron enclosures 6 mm thick painted with chromate primer and gray enamel to provide mechanical protection and moisture seal.

**2.2 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for raceway and boxes installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**2.3 Installation**

- .1 Install boxes on walls of maintenance holes. Splice main cable in box and connect branch feeder. Fasten cover and fill with compound.
  - .1 Ground steel boxes as required.

**2.4 Cleaning**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General****1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA C22.2 No. 18,1-13, Metallic Outlet Boxes.
  - .2 CSA C22.2 No. 45.1-07(R2012), Electrical Rigid Metal Conduit.
  - .3 CSA C22.2 No. 56-13, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .4 CSA C22.2 No. 83-M1985(R2013), Electrical Metallic Tubing.

**1.3 Action And Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
  - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
  - .1 Test reports: submit certified test reports.
  - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .3 Instructions: submit manufacturer's installation instructions.

**1.4 Waste Management And Disposal**

- .1 Separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

**Part 2 Products****2.1 Cables And Reels**

- .1 Provide cables on reels or coils.
  - .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.
- .2 Each coil or reel of cable to contain only one continuous cable without splices.

- .3 Identify cables for exclusively dc applications.

## **2.2 Conduits**

- .1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .4 Rigid pvc conduit: to CSA C22.2 No. 211.2.

## **2.3 Conduit Fastenings**

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
  - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

## **2.4 Conduit Fittings**

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
  - .1 Set-screws are not acceptable.

## **2.5 Fish Cord**

- .1 Polypropylene.

## **Part 3 Execution**

### **3.1 Manufacturer's Instructions**

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

### **3.2 Installation**

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .3 Use rigid hot dipped galvanized steel threaded conduit except where specified otherwise.
- .4 Use electrical metallic tubing (EMT) except in cast concrete.
- .5 Minimum conduit size for lighting and power circuits: 19 mm.



- .6 Bend conduit cold:
  - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .7 Mechanically bend steel conduit over 19 mm diameter.
- .8 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .9 Install fish cord in empty conduits.
- .10 Remove and replace blocked conduit sections.
  - .1 Do not use liquids to clean out conduits.
- .11 Dry conduits out before installing wire.

### **3.3 Concealed Conduits**

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

### **3.4 Cleaning**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

- .1 CSA International
  - .1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.
  - .2 CAN/CSA C22.2 No.42.1-00(R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
  - .3 CSA C22.2 No.55-M1986(R2008), Special Use Switches.
  - .4 CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

**1.3 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4 Closeout Submittals**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for [wiring devices] for incorporation into manual.

**1.5 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect wiring devices from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 Receptacles**

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:
  - .1 White urea moulded housing.
  - .2 Suitable for No. 10 AWG for back and side wiring.
  - .3 Break-off links for use as split receptacles.
  - .4 Eight back wired entrances, four side wiring screws.
  - .5 Triple wipe contacts and rivetted grounding contacts.
- .2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
  - .1 White urea moulded housing.
  - .2 Suitable for No. 10 AWG for back and side wiring.
  - .3 Four back wired entrances, 2 side wiring screws.
- .3 GFI duplex receptacles with following features:
  - .1 White urea moulded housing.
  - .2 suitable for No. 10AWG for back and side wiring.
  - .3 Shall have CSA configuration 5-15R or 5-20R.
  - .2 Class A, 5mAs.
  - .3 Shall be GFI with-in 1.5m from sinks.
- .4 Other receptacles with ampacity and voltage as indicated.
- .5 Receptacles of one manufacturer throughout project.

**2.2 Cover Plates**

- .1 Cover plates for wiring devices to: CSA C22.2 No.42.1
- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 Stainless steel, vertically brushed, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.
- .4 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

**2.3 Source Quality Control**

- .1 Cover plates from one manufacturer throughout project.

**Part 3 Execution**

**3.1 Examination**

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

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Departmental Representative.

### **3.2 Installation**

- .1 Switches:
  - .1 Install single throw switches with handle in "UP" position when switch closed.
  - .2 Install switches in gang type outlet box when more than one switch is required in one location.
  - .3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .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 in accordance with Section 26 05 00 - Common Work Results for Electrical.
  - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
  - .4 Install GFI type receptacles as indicated.
- .3 Cover plates:
  - .1 Install suitable common cover plates where wiring devices are grouped.
  - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

### **3.3 Cleaning**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

### **3.4 Protection**

- .1 Protect installed products and components from damage during construction.
- .2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .3 Repair damage to adjacent materials caused by wiring device installation.

**END OF SECTION**

**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

- .1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  - .1 ANSI/IEEE C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .2 ASTM International Inc.
  - .1 ASTM F1137-00(2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .3 Canadian Standards Association (CSA International)
- .4 ICES-005-07, Radio Frequency Lighting Devices.
- .5 Underwriters' Laboratories of Canada (ULC)

**1.3 Action And Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Departmental Representative.
  - .3 Photometric data to include: spacing criterion.
- .3 Quality assurance submittals: provide following in accordance with Section 01 45 00 - Quality Control.
  - .1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, cleaning procedures.

**1.4 Quality Assurance**

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

**1.5 Delivery, Storage And Handling**

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

- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

## **Part 2 Products**

### **2.1 Drivers**

- .1 LED Drivers
- .2 Reliable and consistent operation
- .3 High efficiency >90%
- .4 Greater than 0.9 PF and Less than 20% THD
- .5 Greater than 50,000 hrs life time
- .6 5-year limited warranty
- .7 ROHS compliance
- .8 Safety approbations (UL, CSA, CE, ENEC, PSE, SELV or CQC)
- .9 Dimmable and Programmable.
- .10 Designed to meet the needs of LED lighting
- .11 Available in either dedicated input voltage or Intellivolt options
- .12 The Adjustable Output Current (AOC) feature
- .13 Specific dimmable versions to enable use of lighting controls to help increase energy saving through a wide variety of protocols, such as 0-10V

### **2.2 Finishes**

- .1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

### **2.3 Optical Control Devices**

- .1 As indicated in luminaire schedule.

### **2.4 Luminaires**

- .1 As indicated in luminaire schedule.

## **Part 3 Execution**

### **3.1 Installation**

- .1 Locate and install luminaires as indicated.
- .2 Provide adequate support to suit ceiling system.

### **3.2 Wiring**

- .1 Connect luminaires to lighting circuits:
  - .1 Install flexible or rigid conduit for luminaires as indicated.

**3.3 Luminaire Supports**

- .1 For suspended ceiling installations support luminaires independently of ceiling, support luminaires from ceiling grid in accordance with local inspection requirements.

**3.4 Luminaire Alignment**

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

**3.5 Cleaning**

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

**END OF SECTION**

**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

- .1 CSA International
  - .1 CSA C22.2 No.141-10, Emergency Lighting Equipment.

**1.3 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4 Closeout Submittals**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for emergency lighting for incorporation into manual.

**1.5 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect emergency lighting from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4

**1.6 Warranty**

- .1 For batteries in this Section 26 52 00 - Emergency Lighting, 12 months warranty period is extended to 120 months.

**Part 2 Products**

**2.1 Equipment**

- .1 Emergency lighting equipment: to CSA C22.2 No.141.



- .2 Supply voltage: 120 V, AC.
- .3 Output voltage: 12 V DC.
- .4 Operating time: 30 minutes.
- .5 Battery: sealed, maintenance free.
- .6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.
- .7 Solid state transfer circuit.
- .8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .9 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.
- .10 Lamp heads: integral on unit and remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 5 W, minimum 340 lumen minimum output.
- .11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .12 Finish: white.
- .13 Auxiliary equipment:
  - .1 Ammeter.
  - .2 Voltmeter.
  - .3 Test switch.
  - .4 Time delay relay.
  - .5 Battery disconnect device.
  - .6 AC input and DC output terminal blocks inside cabinet.
  - .7 Shelf.
  - .8 Cord and single twist-lock plug connection for AC.
  - .9 RFI suppressors.

## **2.2 Wiring Of Remote Heads**

- .1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables (0-1000 V), sized as indicated.

## **Part 3 Execution**

### **3.1 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for emergency lighting installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

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

### **3.2 Installation**

- .1 Install unit equipment and remote mounted fixtures.
- .2 Direct heads.
- .3 Connect exit lights to unit equipment.

### **3.3 Cleaning**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

### **3.4 Protection**

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

**END OF SECTION**

**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.2 No.141-02, Unit Equipment for Emergency Lighting.
  - .2 CSA C860-01(December 2002), Performance of Internally-Lighted Exit Signs.
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 101-2006, Life Safety Code.

**1.3 Action And Informational Submittals**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials.
- .4 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

**Part 2 Products**

**2.1 Standard Units**

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860.
- .2 LED edge lit, extruded acrylic face panels with precision-etched lettering.
- .3 Letters: 150 mm high x 19 mm, with 13 mm thick stroke, red on white glass, reading EXIT-SORTIE.

**Part 3 Execution**

**3.1 Manufacturer's Instructions**

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

### **3.2 Installation**

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
- .2 Connect fixtures to exit light circuits.
- .3 Connect emergency lamp sockets to emergency circuits.
- .4 Ensure that exit light circuit breaker is locked in on position.

### **3.3 Cleaning**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

- .1 CSA International
  - .1 CSA C22.2 No.29-11, Panelboards and Enclosed Panelboards.

**1.3 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Include on drawings:
    - .1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

**1.4 Closeout Submittals**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

**1.5 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect panelboards from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 Panelboards**

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

- .1 Install circuit breakers in panelboards before shipment.
- .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 208V panelboards: bus and breakers rated for 14KA (symmetrical) interrupting capacity or as indicated.
- .3 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.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Minimum of 2 flush locks for each panel board.
- .6 Two keys for each panelboard and key panelboards alike.
- .7 Copper bus with neutral of same ampere rating of mains.
- .8 Mains: suitable for bolt-on breakers.
- .9 Trim with concealed front bolts and hinges.
- .10 Trim and door finish: baked enamel.
- .11 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.

## **2.2 Breakers**

- .1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.
- .4 Lock-on devices for fire alarm, emergency and exit circuits.

## **2.3 Equipment Identification**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.
- .5 Circuits supplying Patient Care Areas must be entered in circuit directory with Bold Font.

**Part 3 Execution**

**3.1 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 Installation**

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards in accordance with Section 06 10 00 - Rough Carpentry. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.

**3.3 Cleaning**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

**3.4 Protection**

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

**END OF SECTION**

**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

- .1 CSA International
  - .1 CSA C22.2 No. 5-09, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

**1.3 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 New 150A-3P branch breaker to match Existing Branch breakers in existing Siemens SPP6 Switchboard(SWBD) (i.e. Manufacturer Name Plate, branch breaker type, System Short Circuit withstand rating of the SWBD.
  - .2 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Include time-current characteristic curves for breakers with interrupting capacity of 65,000 A symmetrical (rms) and over at system voltage( for 150A-3P branch breaker only in Siemens SPP6 SWBD).
- .4 Certificates:
  - .1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.
    - .1 Production certificate of origin must be submitted to Departmental Representative for approval.
  - .2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
  - .3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.
  - .4 Production certificate of origin must contain:
    - .1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.
    - .2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.



- .3 Contractor's name and address and person responsible for project.
- .4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.
- .5 Name and address of building where circuit breakers will be installed:
  - .1 Project title: [\_\_\_\_\_].
  - .2 End user's reference number: [\_\_\_\_\_].
  - .3 List of circuit breakers: [\_\_\_\_\_].

#### **1.4 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store circuit breakers off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect circuit breakers from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

### **Part 2 Products**

#### **2.1 Breakers General**

- .1 Moulded-case circuit breakers: to CSA C22.2 No. 5
- .2 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
  - .1 Trip settings on breakers with Minimum adjustable trips to range from 3-8 times current rating.
- .5 Circuit breakers with interchangeable trips as indicated.
- .6 Circuit breakers to have minimum 65kA symmetrical rms interrupting capacity rating (for 150A-3P Branch breaker in Siemens SPP6 SWBD).

#### **2.2 Thermal Magnetic Breakers**

- .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**

- .1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

## **2.4 Optional Features**

- .1 Include:
  - .1 Shunt trip.
  - .2 Auxiliary switch.
  - .3 Motor-operated mechanism c/w time delay unit.
  - .4 Under-voltage release.
  - .5 On-off locking device.
  - .6 Handle mechanism.

## **Part 3 Execution**

### **3.1 Examination**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 Installation**

- .1 Install circuit breakers as indicated.

### **3.3 Cleaning**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Note Used

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for communications equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Construction/Demolition Waste Management and Disposal in accordance with Section 10 74 21

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect communications equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section  
Packaging Waste Management: remove for reuse and return by manufacturer of.  
packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 GROUNDING CONDUCTOR**

- .1 Inspect Ground wire for cable tray and provide No. 6 AWG stranded annealed copper conductor with colour Green polyvinyl chloride insulation designed for ground connections to protect cable terminals and protectors should it not exist on the cable tray.

Part 3 Execution

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communications equipment installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 INSTALLATION**

- .1 Inspect grounding and ensure a continuous bond of the cable tray exists for the project.

**3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**2.4 PROTECTION**

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

**END OF SECTION**

**Part 1 General****1.1 RELATED REQUIREMENTS**

- .1 Not Used

**1.2 REFERENCES**

- .1 American National Standards Institute
  - .1 ANSI J-STD-607-B-2011, Joint Standard - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
- .2 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA)
  - .1 TIA/EIA-606-B-2012, Administration Standard for the Commercial Telecommunications Infrastructure.
- .3 U.S. Department of Labor/Occupational Safety and Health Administration (OSHA)
  - .1 Nationally Recognized Testing Laboratory (NRTL).
- .4 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-15, Canadian Electrical Code 23rd Ed.
- .5 Building Industry Consulting Services International (BICSI)
  - .1 BICSI Telecommunications Distribution Methods Manual 13th Edition

**1.3 SYSTEM DESCRIPTION**

- .1 Telecommunications grounding and bonding system consist of grounding busbars, bonding backbones, and other bonding conductors.
- .2 Provides ground reference for telecommunications systems within building and bonding to it of telecommunications rooms.
- .3 Metallic pathways, cable shields, conductors, and hardware within telecommunications spaces are bonded to telecommunications grounding and bonding system.

**1.4 QUALITY ASSURANCE**

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

**1.5 DELIVERY, STORAGE AND HANDLING**

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

**Part 2 Products****2.1 TELECOMMUNICATIONS GROUNDING BUSBAR (TGB)**

- .1 A Pre-drilled electroplated copper Busbar with holes for use with standard 2 hole lugs with standard NEMA bolt hole sizing and spacing..

- .2 Shall be sized accordance with the immediate connection requirements with a minimum of 4 extra sets of holes.
  - .3 Shall be a minimum size of 6mm thick, 53mm high and variable in length.
  - .4 Shall include Insulated supports with a minimum of 50mm separation from mount.
  - .5 Shall be listed by a nationally recognized testing laboratory.
  - .6 Acceptable Products: Cable-Talk CT-BIBB 2X10-12, Panduit GB2B0306TPI-1, Erico TGB-A14L06PT.
- 2.2 Bonding Conductor for Telecommunications
- .1 3/0 AWG stranded copper conductor, green insulated marked to: ANSI J-STD-607-B.
- 2.3 Telecommunications Bonding Backbone (TBB)
- .1 3/0 AWG stranded copper conductor, green insulated marked to: ANSI J-STD-607-B.
- 2.4 Grounding Equalizer (GE)
- .1 3/0 AWG stranded copper conductor, green insulated marked to: ANSI J-STD-607-B.
- 2.5 Equipment Bonding Conductor (EC)
- .1 6 AWG stranded copper conductor, green insulated marked to: ANSI J-STD-607-B.
- 2.6 Raceway Bonding Conductor (RBC)
- .1 6 AWG stranded copper conductor, green insulated marked to: ANSI J-STD-607-B.
- 2.7 Bonding Conductor Termination
- .1 Two-Hole compression lugs, long barrel type, sized as per AWG of cable.
  - .2 High conductivity wrought copper.
  - .3 Electro tin plated
  - .4 Hole spacing as per TMGB and TGB.
- 2.8 Insulated Conduit Ground Bushings
- .1 Each Metal Conduit originating in the Telecom Entrance Facility, Telecom Room or Equipment Room shall be directly connected to the TMGB or TGB via a compression lug.
  - .2 Ground bushing shall be insulated.
- 2.9 Bonding And Grounding Clamps
- .1 All ground wires originating at the TMGB or TGB shall be clamped to the plywood backboard "B" ground wire clamps.
  - .2 Shall be mechanically galvanized ASTM B695
  - .3 5.6mm hole diameter
- 2.10 Cable Tray Bonding Clamps
- .1 Shall be constructed of malleable iron
  - .2 Zinc plated

- .3 Shall allow for clamping of ground wire of multiple gauges.
- 2.11 Warning Labels
  - .1 Non-metallic warning labels in English and French to: ANSI J-STD-607-B.
  - .2 Identify labels with wording "If this connector is loose or must be removed, please call the building telecommunications manager".
- Part 3 Execution
  - 3.1 General Installation Requirements
    - .1 Install all Bonding Conductors as per CEC. And manufacturers recommended installation procedures.
  - 3.2 Telecommunications Grounding Busbar (TGB)
    - .1 Install TGB in main terminal/equipment room and each telecommunications room.
    - .2 Install 3/0 AWG copper bonding conductor from TGB to alternating current equipment ground (ACEG) of serving electrical power panel (panelboard) or main electrical grounding bus bar.
  - 3.3 Bonding Conductors General
    - .1 When placed in ferrous metallic conduit or EMT longer than 1 m, bond to each end of conduit or EMT using grounding bushing and #6 AWG copper conductor.
  - 3.4 Bonding Conductor For Telecommunications
    - .1 Install bonding conductor for telecommunications from TMGB to service equipment (power) ground.
    - .2 Use approved 2-hole compression lugs for connection to TMGB.
  - 3.5 Telecommunications Bonding Backbone (TBB)
    - .1 Install TBB from TMGB to each TGB as indicated.
    - .2 Use approved 2-hole compression lugs for connection to TMGB and TGBs.
  - 3.6 Grounding Equalizer (GE)
    - .1 Install GE between TBBs in multi-storey building by bonding TGBs with GE on top floor and every third floor in between top and bottom floors.
  - 3.7 Bonding to TGB
    - .1 Bond metallic raceways in telecommunications room to TGB using #6 AWG green insulated copper conductor.
    - .2 For cables within telecommunications room having shield or metallic member, bond shield or metallic member to TGB using #12 AWG green insulated copper conductor.
    - .3 Bond equipment rack and cabinet located in telecommunications room to TGB using #6 AWG green insulated copper conductor.

3.8 Labelling

- .1 Apply warning labels to telecommunications bonding and grounding conductors.
- .2 Apply additional administrative labels to: TIA/EIA-606-B.

END OF SECTION



**Part 1 General****1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)/Telecommunications Industry Association (TIA)
  - .1 ANSI/TIA-569-C-2012, Telecommunications Pathways and Spaces
- .2 Building Industry Consulting Services International (BICSI)
  - .1 BICSI Telecommunications Distribution Methods Manual 13th Edition
- .3 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-12, Canadian Electrical Code

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for communication raceway systems and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
    - .2 Submit Construction/Demolition Waste Management and Disposal in accordance with Section 01 74 21.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect communication raceway systems from [nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products****2.1 SYSTEM DESCRIPTION**

- .1 Empty telecommunications raceways system consists of outlet boxes, cover plates, single gang raise plaster adapter ring, distribution cabinets, conduits, cable trays, pull boxes, sleeves and caps, fish wires, service poles, service fittings, surface raceways, floor boxes.
- .2 Empty Security systems raceways system consists of outlet boxes, cover plates, single gang raise plaster adapter ring, conduits, cable trays, pull boxes, sleeves and caps, fish wires.
- .3 Overhead main cable tray distribution system and combination J-hook/conduit to device outlet installed in accessible ceiling space.
- .4 Voice and data cabling installation is not in contract. Shared Service Canada (SSC) is responsible for the installation, termination and testing of voice and data cabling.
- .5 Intrusion alarm and Access control cabling installation and equipment are not in contract. Owner is responsible for the installation, termination, testing and supply of a complete intrusion alarm and access control system.
- .6 Contractor is responsible to provide a separate complete pathway system for voice/data, intrusion alarm and access control systems.

**2.2 HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS**

- .1 Cable tray shall be supported by Cantilever brackets, Trapeze Brackets, or individual rod suspension. Supports shall be approved types of wall brackets or trapeze hangers. Additional bracing may be required for seismic restraints.
- .2 Conduits entering a room shall be appropriately racked on a trapeze support suspended from the structure.
- .3 Cable tray shall be supported via Manufactures brackets, or supports manufactured on site using Unistrut or B-line channel, meeting all the manufacturers' requirements for loading.
- .4 Conduits should be independently supported, free from any other mechanical system.
- .5 Conduit and cable tray support systems shall be securely and adequately installed to preclude movement of conduit and cable tray during pulling operations.
- .6 J-hooks are authorized for Communications Distribution installed in fixed ceiling space.

**2.3 CONDUIT, PULL BOXES AND OUTLET BOXES FOR COMMUNICATIONS AND SECURITY SYSTEMS**

- .1 Metallic Conduit
  - .1 Thin Wall EMT, reamed and bushed at both ends.
  - .2 Minimum Size for communications is 27mm inside diameter.
  - .3 Installed above ceilings, under access floors and in walls only; not acceptable for in floor use.
  - .4 Conduits, conduit fittings, hanger and supports: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings, Section 26 05 29 Hangers and Support for Electrical Systems, Section 26 05 33 Raceway and Boxes for Electrical System

- .5 Fish wire: polypropylene type.
- .2 Pull Boxes
  - .1 Shall be made of code gauge steel and shall have a rust resistant finish.
  - .2 Shall be constructed in accordance with Canadian Standards Association.
  - .3 Shall be sized in accordance with ANSI/TIA/EIA-569B, Table 12.
  - .4 Pull Boxes for Security systems shall not have pre-punched knockouts.
  - .5 Junction boxes, cabinets type: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .3 Outlet Boxes for communications systems
  - .1 Shall be a minimum size of 100mm x 100mm x 65mm deep.
  - .2 Shall have a raised Plaster adapter ring sized for a single gang opening for communications Outlets.
  - .3 Shall have raised plaster adapter ring sized for Access Control devices.
  - .4 Shall have raised plaster adapter ring sized for Intrusion Alarm devices.
  - .5 Outlet boxes 2-gang type with single gang plaster ring, conduit, and fittings: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- 2.4 OVER FLOOR RACEWAY FOR COMMUNICATIONS, AUDIO/VIDEO SYSTEMS AND ELECTRICAL RECEPTACLE
  - .1 Provide surface raceway systems for branch circuit and data network voice, video and other low-voltage wiring. Surface raceway system shall consist of covers, pre-divided raceway bases appropriate fittings and device mounting plates necessary for a complete installation.
  - .2 For continuation of over floor raceway to wall mounted device outlets for HDMI, VGA, mini-stereo jack and RJ-45 jack and electrical outlet, provide conduit in the East wall cavity up to device box mounted behind the video conferencing monitor.
  - .3 Raceways shall be multi-piece design with metal base and snap-on metal covers. Assembled base and cover is 178mm wide by 13mm high. Height of assembled base and cover increases from 0mm at edge to 12.7mm with a slope of no less than 1:2.
  - .4 Base shall have 4 wiring channels, separated by 3 integral dividers. Base shall be suitable for mounting directly to bare concrete or floor coverings.
  - .5 Fittings shall include flat, external elbows, couplings for joining raceway sections, wire clips, blank end fittings, and device mounting brackets and plates as applicable. Where required, provide tamper-resistant form, dividable with barriers and matching the size of the accompanying raceway base. Provide full capacity corner elbows to maintain a controlled 51mm cable bend radius, meeting the specification for Fiber Optic and UTP cabling and exceeding the TIA/EIA-569-A requirements for communications pathways.
  - .6 Device Brackets and Plates: Provide in sizes to match raceway width and with mounting holes located to ensure proper mounting of devices in up to 4 compartments. Provide long device plates with a flange to overlap the joint of adjacent cover as applicable.
  - .7 Communications Devices and Accessories: Raceway shall accommodate a complete line of connectivity outlets and modular inserts for UTP (including Category 5, 5e, 6) VGA cable, and other cabling types with matching faceplates and bezels to facilitate mounting. Provide connectivity outlets and modular inserts such as VGA, HDMI, RJ-45, mini-stereo jack by Ortronics or approved equal.

**Part 3 Execution****3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communication raceway systems installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 INSTALLATION**

- .1 Install empty raceway system, including underfloor overhead distribution system, pull cord, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable tray, service poles, miscellaneous and positioning material to constitute complete system.
- .1 Install all systems as per the CEC and manufacturers recommended installation procedures.
- .2 Ground and bond all conduits and cable tray in accordance with section 27 05 26 and CEC.
- .3 Provide separate conduit/cable tray system for the following systems:
  - .1 Intrusion Alarm System
  - .2 Access Control System
  - .3 Telecommunications System
- .4 Electrical Metallic Tubing (EMT) conduits for all Voice Data Systems, Access Control minimum size to be 27mm unless specified otherwise.
- .5 Electrical Metallic Tubing (EMT) conduits for all Intrusion Alarm systems minimum size to be 21mm unless specified otherwise.
- .6 Provide the following separation from Electrical Power systems installed in conduits:
  - .1 300mm from circuits of 300Volt and less.
  - .2 600mm from circuits 300Volt and higher.
  - .3 2 Metres from Circuits between 600V and 15KV.
  - .4 3 Metres for circuits above 15KV.
  - .5 Electrical or Mechanical systems cannot share the same cable tray or be racked on the same support structure.
- .7 Heights of Communications system Outlet Boxes:
  - .1 Telecommunications outlets, 400mm Above Finished Floor (AFF) (the same height as adjacent receptacles)
  - .2 Wall Mounted Telephones or Intercom, 1220mm AFF.
  - .3 Access control Card readers, 1100mm AFF.
  - .4 Intrusion alarm keypads, 1400mm AFF

- .5 Barrier Free Buttons, 900mm AFF
- .6 Door Contacts, on leading edge of door frame at top of frame.

### **3.3 INSTALLATION OF HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS.**

- .1 Support Cable tray of approved types of wall brackets, trapeze supports. Plumbers perforated straps are not permitted means of supports.
- .2 Centre hung cable tray is not acceptable for communications cabling.
- .3 Conduits and equipment shall be independently supported, free from any other mechanical system.
- .4 Conduit and Cable Tray support systems shall be securely and adequately installed to preclude movement of conduit and cable tray during pulling operations.
- .5 Communications outlet boxes shall not be placed back to back with another communications outlet box or any other box.
- .6 Maximum Height for installed communications systems is 11ft.
- .7 Only communications system can be attached to the trapeze supports of the cable tray.
- .8 Power or mechanical controls shall not be attached to communications racking.

### **3.4 INSTALLATION OF CONDUIT, PULL BOXES AND OUTLET BOXES FOR COMMUNICATIONS SYSTEMS.**

- .1 Conduit Installation Requirements
  - .1 All Communications systems shall be installed in conduit or cable tray unless otherwise indicated.
  - .2 The inside radius of a bend in conduit shall be not less than 10 times the internal diameter of the conduit.
  - .3 All Conduits shall be identified and labelled at both ends. Tags shall identify start and finish of conduit.
  - .4 A Maximum of one communications outlet per 27mm conduit run.
  - .5 Back to back or offset outlets shall not be used.
  - .6 All Conduits shall originate in the communications room, pull box or cable tray.
  - .7 Conduits shall be rigidly and adequately fastened to withstand pulling tensions as per manufacturer's recommendations.
  - .8 Conduits must follow building lines.
  - .9 90-degree LB, LL, LR, or condulets shall not be used in any instance for communications cabling.
  - .10 A pull box shall be installed in conduit runs where:
    - .1 The length of conduit is over 30 metres
    - .2 There are more than two 90-degree bends
  - .11 Offsets or kicks are to be considered 90 degree bend for communications
  - .12 Conduits protruding through the floor shall be terminated 25-50 mm above the finished floor.
  - .13 Riser sleeves protruding through the floor shall be terminated 25-75mm above the finished floor, including sleeve and bonding bushing.

- .14 Conduits entering and exiting through the ceiling of a communications Room (TR) shall protrude into the room 25-50mm above the 2400mm level.
  - .15 All zone conduits entering a TR (unless otherwise stipulated will protrude into the TR from 25-50 mm without a bend.
  - .16 The maximum fill rate authorized for conduits is 40 percent.
  - .17 Pull boxes shall not be installed higher than 3353mm above finished floor. Approval of this deviation is on a case by case basis.
  - .18 Communications conduits shall NEVER be run over:
    - .1 Boilers
    - .2 Incinerators
    - .3 Hot Water lines
    - .4 Steam lines
    - .5 Electrical rooms and Closets
    - .6 Washrooms
  - .19 All Conduits shall be bonded in accordance with section 27 05 26 and the CEC.
  - .20 All Conduits shall use the trapeze hanger method to support the conduits, shall use threaded rod not less than 3/8" diameter.
  - .21 Install pull string in all conduits and cable tray tied at both ends for installation by Voice data system contractor.
- .2 PULL BOX INSTALLATION REQUIREMENTS
- .1 In all instances pull boxes shall be placed in straight sections of a conduit run and shall NOT be used in lieu of a bend. Corresponding ends of the conduit are to be aligned with each other. Conduit fittings shall not be used in place of pull boxes. Conduits shall always protrude in the direction of pull. Conduits shall not exit the sides bottom or back of the pull box.
  - .2 All Communications system conduits including Intrusion Alarm and Access control shall follow the requirements of this section.
  - .3 Pull boxes shall be placed in an exposed location, and readily accessible. Pull boxes shall not be placed in a fixed false ceiling space, unless immediately above a suitably marked and hinged panel. If the pull box is installed above a suspended type ceiling a green indicator dot shall be placed on ceiling t-rail to indicate the location of pull box.
  - .4 All Boxes shall be adequately secured. They shall not be supported by the conduits entering the box.
  - .5 Riser cables and Communications outlet cannot share the same conduit system or pull boxes.
- .3 OUTLET BOX INSTALLATION REQUIREMENTS
- .1 Install communications Outlet boxes for voice data systems same level as adjacent receptacles and flush to the wall wherever possible.
  - .2 Where communications Outlets are installed in steel stud type systems, provide additional cross bracing and or straps to make the installation completely rigid prior to the application of the wall facing material.
  - .3 Back to back and offset outlets shall not be used.
  - .4 Apply appropriate acoustic sealing as necessary on back of communications outlet boxes to ensure the STC rating is maintained.

- .5 Ensure conduits are installed not to de-rate the STC rating of the wall.
- .6 Ensure Outlet Box is mechanically bonded to the Conduit system.
- .7 Conduits must enter the outlet box from the top or bottom.

### **3.5 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse, recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.6 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by pathways for communications systems installation.

**END OF SECTION**

**Part 1 General****1.1 RELATED REQUIREMENTS**

- .1 Not Used

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA-C22.2 No. 214-02, Communications Cables (Bi-National standard with UL 444).
- .2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)
  - .1 TIA/EIA-568-C.1-2011, Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
  - .2 TIA/EIA-568-C.2-(2011), Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
  - .3 TIA/EIA-606-A-(2008), Administration Standard for the Commercial Telecommunications Infrastructure.
  - .4 TIA TSB-140-2004, Telecommunications Systems Bulletin - Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.

**1.3 DEFINITIONS**

- .1 Refer to TIA/EIA-598-D, Annex A for definitions of terms: optical-fiber interconnect, distribution, and breakout cables.

**1.4 SYSTEM DESCRIPTION**

- .1 Structured telecommunications wiring system consist of unshielded-twisted-pair and optical fiber cables, terminations, connectors, cross-connection hardware and related equipment installed inside building for occupant's telecommunications systems, including voice (telephone), data, and image.
- .2 Shared Services Canada (SSC) is responsible for the supply and installation of a complete horizontal and backbone cabling infrastructure and equipment.
- .3 Owner is responsible for the supply and installation of a complete Access control and Intrusion alarm system.
- .4 Contractor will provide a separate conduit pathway rough-in infrastructure for voice and data, access control and intrusion alarm system. Rough-in to include 100 x 100 x 65mm device box complete with single gang raised plaster ring, pull boxes, bushing, bonding and grounding. All empty conduits to be provided with pull string.

**END OF SECTION**



## **Part 1 General**

### **1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)/Telecommunications Industry Association (TIA)
  - .1 ANSI/TIA-569-C-2012, Telecommunications Pathways and Spaces
- .2 Building Industry Consulting Services International (BICSI)
  - .1 BICSI Telecommunications Distribution Methods Manual 13th Edition
- .3 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-12, Canadian Electrical Code

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for communication raceway systems and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Provide factory service manuals Owners manuals and Factory provided cables not used for installation for all active equipment components with the O&M manuals.
- .3 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
    - .2 Submit Construction/Demolition Waste Management and Disposal in accordance with Section 01 74 21.

### **1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect communication raceway systems from [nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

- .5 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## Part 2 Products

### 2.1 LCD MONITOR TYPE 1 (32 INCH)

- .1 Panel
  - .1 Diagonal Size Resolution: 1920\*1080 (Full HD)
  - .2 Active Display Area(mm): 698.4(H) x 392.85(V)
  - .3 Contrast Ratio: 5000:1
  - .4 Response Time(G-to-G): 8ms
  - .5 Color Gamut: .72
  - .6 Type: 60Hz D-LED BLU
  - .7 Pixel Pitch(mm): 0.12125(H) x 0.36375(V)
  - .8 Brightness(Typ.): 400 Nit
  - .9 Viewing Angle(H/V): 178:178
  - .10 Display Colors: 10bit Dithering - 1.07Billion
- .2 Display
  - .1 Dynamic C/R: 50,000:1
  - .2 V-Scanning Frequency: 48 ~ 75HZ
  - .3 H-Scanning Frequency: 30 ~ 81kHz
  - .4 Speaker Type: Built in Speaker (10W x 1)
- .3 Connectivity
  - .1 Input
    - .1 RGB: Analog D-SUB, DVI-D(HDMI Common)
    - .2 Video: HDMI1 Component (CVBS Common)
    - .3 Audio: Stereo mini Jack
    - .4 Usb: USB 2.0 x 1
  - .2 Output
    - .1 Audio: Stereo mini Jack
    - .2 External Control: RS232C(in/out) thru stereo jack, RJ45
    - .3 External Sensor: IR, Ambient Light
    - .4 Tuner: Yes(only for NA/KR)
- .4 Power
  - .1 Type: Internal
  - .2 Power Supply: AC 100 - 240 V~ (+/- 10 %), 50/60 Hz
  - .3 Max: 77w
  - .4 Typical[W/h]: 55 (w/w), 30 (us), 57 (kor)
  - .5 BTU(Max): 262.57
- .5 Operation: 24/7

## 2.2 LCD MONITOR TYPE 2 (40 INCH)

- .1 Panel
  - .1 Diagonal Size Resolution: 1920\*1080 (Full HD)
  - .2 Active Display Area(mm): 885.6(H) x 498.15(V)
  - .3 Contrast Ratio: 5000:1
  - .4 Response Time(G-to-G): 8ms
  - .5 Color Gamut: .72
  - .6 Type: 60Hz D-LED BLU
  - .7 Pixel Pitch(mm): 0.15375(H) x 0.46125(V)
  - .8 Brightness(Typ.): 450 Nit
  - .9 Viewing Angle(H/V): 178:178
  - .10 Display Colors: 10bit Dithering - 1.07Billion
- .2 Display
  - .1 Dynamic C/R: 50,000:1
  - .2 V-Scanning Frequency: 48 ~ 75HZ
  - .3 H-Scanning Frequency: 30 ~ 81kHz
  - .4 Speaker Type: Built in Speaker (10W x 1)
- .3 Connectivity
  - .1 Input
    - .1 RGB: Analog D-SUB, DVI-D(HDMI Common), Display Port 1.2
    - .2 Video: HDMI1, HDMI2(except KR, NA) Component (CVBS Common)
    - .3 Audio: Stereo mini Jack
    - .4 Usb: USB 2.0 x 1
  - .2 Output
    - .1 Audio: Stereo mini Jack
    - .2 External Control: RS232C(in/out) thru stereo jack, RJ45
    - .3 External Sensor: IR, Ambient Light
    - .4 Tuner: Yes(only for NA/KR)
- .4 Power
  - .1 Type: Internal
  - .2 Power Supply: AC 100 - 240 V~ (+/- 10 %), 50/60 Hz
  - .3 Max: 121w
  - .4 Typical[W/h]: 81 (w/w), 44 (us), 85 (kor)
  - .5 BTU(Max): 412.61
- .5 Operation: 24/7

## 2.3 LCD MONITOR WALL MOUNT

- .1 VESA compatibility: 200x200
- .2 Touch Overlay compatibility: Supported
- .3 Installation orientation: Landscape and Portrait
- .4 (W\*H\*D, mm): 48.0 x 255.0 x 30.0

- .5 Weight (kg): 2.4
- .6 Minimum wall thickness (mm): 30
- .7 Tilt/Swivel: 10 degrees tilt, 20 degrees swivel
- .8 To be compatible with supplied LCD Monitor and same Manufacturer

## **2.4 BLUERAY PLAYER**

- .1 General
  - .1 Signal System: NTSC Colour
  - .2 Power Requirements: AC 120v, 60Hz
  - .3 Power Consumption: 12w
  - .4 Operating Temperature: 5c to 35c
  - .5 Dimensions 483 x 45 x 257.8mm
  - .6 Weight 2.26 Kg
  - .7 Rack mountable
  - .8 HDMI Output: 480p, 720p, 1080p 1080P24/Audio
  - .9 Analogue outputs: RCA Jack (unbalanced), XLR (Balanced)
  - .10 Digital Outputs: RCA Jack, Optical Jack
  - .11 USB Input: Type A, USB 2.0
  - .12 Ethernet: 10base-T/100Base-TX
  - .13 RS-232C D-sub 9 Pin
  - .14 Audio
    - .1 BD Linear Audio: 4hz-88khz (192 Khz)
    - .2 DVD Linear Audio: 4Hz-44Khz (96Khz)
    - .3 Audio CD: 20Hz-20 Khz
    - .4 Total Harmonic Distortion: .01%
    - .5 Signal to Noise Ratio: 90db
    - .6 Audio Dynamic Range: 90db
    - .7 Channel Separation: 90db

## **2.5 HDMI TRANSMITTER TYPE 1 (EXTENDER TRANSMITTER)**

- .1 Video Input Support: HDMI, VGA
- .2 Video output Support: HDMI, HDBaseT
- .3 Maximum VGA Resolution: 1080P
- .4 Maximum HDMI Resolution: 4K
- .5 Maximum Distance Supported: 35m @ 3840 x 2160
- .6 Video/Audio Inputs: HDMI x2, VGA, 3.5mm Stereo
- .7 DATA/Video output port: RJ45, Rj11, HDMI
- .8 Dimensions 160x100x400mm
- .9 Power adapter: 120-240 VAC 50-60Hz
- .10 Output Voltage .6a, 18vdc, 1.0A
- .11 Warranty: 3 Years

## **2.6 HDMI TRANSMITTER TYPE 2 (WALL PLATE TRANSMITTER)**

- .1 Maximum Distance Supported: 70m @ 1920 x 1080
- .2 Maximum Distance Supported: 35m @ 3840 x 2160
- .3 Maximum Resolution Supported: 3840 x 2160 (UHD-HDMI), 1920 x 1200 VGA, HDBaseT, HDCP, Serial Control
- .4 Power adapter: 120-240 VAC 50-60Hz
- .5 Output Voltage .6a, 18vdc, 1.0A
- .6 Warranty: 3 Years

## **2.7 HDMI RECEIVER**

- .1 Video Signal Support - HDMI
- .2 HDMI Features Supported - HDCP, 3D, Deep color, Dolby + DTS 7.1 Audio, Consumer Electronics Control (CEC)
- .3 Maximum video resolution - 1080p
- .4 Power adapter: 120-240 VAC 50-60Hz
- .5 Output Voltage, 18vdc, 1.0A
- .6 Warranty: 3 Years

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communication raceway systems installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 INSTALLATION**

- .1 Install empty raceway system, including underfloor overhead distribution system, pull cord, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable tray, service poles, miscellaneous and positioning material to constitute complete system.
- .1 Install all systems as per the CEC and manufacturers recommended installation procedures.
- .2 Ground and bond all conduits and cable tray in accordance with section 27 05 26 and CEC.

- .3 Provide separate conduit/cable tray system for the following systems:
  - .1 Intrusion Alarm System
  - .2 Access Control System
  - .3 Telecommunications System
- .4 Electrical Metallic Tubing (EMT) conduits for all Voice Data Systems, Access Control minimum size to be 27mm unless specified otherwise.
- .5 Electrical Metallic Tubing (EMT) conduits for all Intrusion Alarm systems minimum size to be 21mm unless specified otherwise.
- .6 Provide the following separation from Electrical Power systems installed in conduits:
  - .1 300mm from circuits of 300Volt and less.
  - .2 600mm from circuits 300Volt and higher.
  - .3 2 Metres from Circuits between 600V and 15KV.
  - .4 3 Metres for circuits above 15KV.
  - .5 Electrical or Mechanical systems cannot share the same cable tray or be racked on the same support structure.
- .7 Heights of Communications system Outlet Boxes:
  - .1 Telecommunications outlets, 400mm Above Finished Floor (AFF) (the same height as adjacent receptacles)
  - .2 Wall Mounted Telephones or Intercom, 1220mm AFF.
  - .3 Access control Card readers, 1100mm AFF.
  - .4 Intrusion alarm keypads, 1400mm AFF
  - .5 Barrier Free Buttons, 900mm AFF
  - .6 Door Contacts, on leading edge of door frame at top of frame.

### **3.3 INSTALLATION OF HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS.**

- .1 Support Cable tray of approved types of wall brackets, trapeze supports. Plumbers perforated straps are not permitted means of supports.
- .2 Centre hung cable tray is not acceptable for communications cabling.
- .3 Conduits and equipment shall be independently supported, free from any other mechanical system.
- .4 Conduit and Cable Tray support systems shall be securely and adequately installed to preclude movement of conduit and cable tray during pulling operations.
- .5 Communications outlet boxes shall not be placed back to back with another communications outlet box or any other box.
- .6 Maximum Height for installed communications systems is 11ft.
- .7 Only communications system can be attached to the trapeze supports of the cable tray.
- .8 Power or mechanical controls shall not be attached to communications racking.

### **3.4 INSTALLATION OF CONDUIT, PULL BOXES AND OUTLET BOXES FOR COMMUNICATIONS SYSTEMS.**

- .1 Conduit Installation Requirements

- .1 All Communications systems shall be installed in conduit or cable tray unless otherwise indicated.
  - .2 The inside radius of a bend in conduit shall be not less than 10 times the internal diameter of the conduit.
  - .3 All Conduits shall be identified and labelled at both ends. Tags shall identify start and finish of conduit.
  - .4 A Maximum of one communications outlet per 27mm conduit run.
  - .5 Back to back or offset outlets shall not be used.
  - .6 All Conduits shall originate in the communications room, pull box or cable tray.
  - .7 Conduits shall be rigidly and adequately fastened to withstand pulling tensions as per manufacturer's recommendations.
  - .8 Conduits must follow building lines.
  - .9 90-degree LB, LL, LR, or condulets shall not be used in any instance for communications cabling.
  - .10 A pull box shall be installed in conduit runs where:
    - .1 The length of conduit is over 30 metres
    - .2 There are more than two 90-degree bends
  - .11 Offsets or kicks are to be considered 90 degree bend for communications
  - .12 Conduits protruding through the floor shall be terminated 25-50 mm above the finished floor.
  - .13 Riser sleeves protruding through the floor shall be terminated 25-75mm above the finished floor, including sleeve and bonding bushing.
  - .14 Conduits entering and exiting through the ceiling of a communications Room (TR) shall protrude into the room 25-50mm above the 2400mm level.
  - .15 All zone conduits entering a TR (unless otherwise stipulated will protrude into the TR from 25-50 mm without a bend.
  - .16 The maximum fill rate authorized for conduits is 40 percent.
  - .17 Pull boxes shall not be installed higher than 3353mm above finished floor. Approval of this deviation is on a case by case basis.
  - .18 Communications conduits shall NEVER be run over:
    - .1 Boilers
    - .2 Incinerators
    - .3 Hot Water lines
    - .4 Steam lines
    - .5 Electrical rooms and Closets
    - .6 Washrooms
  - .19 All Conduits shall be bonded in accordance with section 27 05 26 and the CEC.
  - .20 All Conduits shall use the trapeze hanger method to support the conduits, shall use threaded rod not less than 3/8" diameter.
  - .21 Install pull string in all conduits and cable tray tied at both ends for installation by Voice data system contractor.
- .2 PULL BOX INSTALLATION REQUIREMENTS
- .1 In all instances pull boxes shall be placed in straight sections of a conduit run and shall NOT be used in lieu of a bend. Corresponding ends of the conduit are to be aligned with each other. Conduit fittings shall not be used in place of pull

boxes. Conduits shall always protrude in the direction of pull. Conduits shall not exit the sides bottom or back of the pull box.

- .2 All Communications system conduits including Intrusion Alarm and Access control shall follow the requirements of this section.
- .3 Pull boxes shall be placed in an exposed location, and readily accessible. Pull boxes shall not be placed in a fixed false ceiling space, unless immediately above a suitably marked and hinged panel. If the pull box is installed above a suspended type ceiling a green indicator dot shall be placed on ceiling t-rail to indicate the location of pull box.
- .4 All Boxes shall be adequately secured. They shall not be supported by the conduits entering the box.
- .5 Riser cables and Communications outlet cannot share the same conduit system or pull boxes.

.3 OUTLET BOX INSTALLATION REQUIREMENTS

- .1 Install communications Outlet boxes for voice data systems same level as adjacent receptacles and flush to the wall wherever possible.
- .2 Where communications Outlets are installed in steel stud type systems, provide additional cross bracing and or straps to make the installation completely rigid prior to the application of the wall facing material.
- .3 Back to back and offset outlets shall not be used.
- .4 Apply appropriate acoustic sealing as necessary on back of communications outlet boxes to ensure the STC rating is maintained.
- .5 Ensure conduits are installed not to de-rate the STC rating of the wall.
- .6 Ensure Outlet Box is mechanically bonded to the Conduit system.
- .7 Conduits must enter the outlet box from the top or bottom.

### 3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse, recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### 3.6 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by pathways for communications systems installation.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM E1374-06 (11) – Standard Guide for Open Office Acoustics and Applicable ASTM Standards
- .2 ASTM E1573-09 – Standard Test Method for Evaluating Masking Sound in Open Office Using A-Weighted and One-Third Octave Band Sound Pressure Levels
- .3 ASTM E1130-08 – Standard Test Method for Objective Measurement of Speech Privacy in Open Offices Using Articulation Index
- .4 ASTM E2638 – Standard Test Method for Objective Measurement of Speech Privacy Provide by Closed Rooms
- .5 Acoustical Design of Conventional Open Plan Offices, Canadian Acoustics, vol 27, no. 3, 2003 (NRCC-46274)

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for Sound Masking systems and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Include single line diagram, sound masking speaker layout of complete Sound Masking system.
- .3 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for Sound Masking systems for incorporation into manual.
- .3 Include parts list using component identification numbers standard to electronics industry.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
  - .1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address. Inspect manufacturer's packages upon receipt.
- .2 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Store and protect Sound Masking systems from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Protect from moisture during shipping, storage and handling.
- .5 Handle packages carefully.
- .3 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Conduits: size as indicated, in accordance with Section 26 05 00 - Common Work Results for Electrical and in accordance with Section 27 05 28 - Pathways for Communications Systems.
- .2 Communication conductors: type and size as indicated, in accordance with manufacturer's cable type and sizes, to be CMP or FT6 rated.

### **2.2 SYSTEM DESCRIPTION**

- .1 The contractor shall supply and install a complete and operational Sound Masking System as indicated in the plan.
- .2 The sound masking speaker shall either be direct field, radiating directly into space or radiating upwards in the ceiling space.
- .3 The sound masking system shall automatically adjust based on the room's ambient noise level or timer based system or has wall mounted volume control system.
- .4 System Architecture
  - 1. The system shall be of a networked decentralized architecture with addressable masking devices distributed throughout the installation area.
  - 2. The sound masking system shall be arranged into zones from 1 to 6 speakers.
    - .1 Each zone shall be individually addressable and controllable for both volume and spectrum for fine tuning of the system.
- .5 Sound masking generating system
  - 1. The system shall use digital signal processing (DSP) technology for masking sound generation and output adjustment of masking signals.
  - 2. Sound masking generator shall include an automatic calibration process on 340 narrow bands or third-octave bands from 100Hz to 6.3kHz based on DSP technology.
  - 3. The masking sound shall be generated via a truly-random, non-deterministic digital process with no repeat cycle.

4. The system shall provide independently controllable masking zones that efficiently allow the ability to control and monitor the operation of each zone and provide:
  - .1 A third-octave equalizer per zone with minimum 18 bands, ranging from 100Hz to 6 300Hz
  - .2 Possibility to select specific spectrum for each masking zone.
  - .3 Definition of the sound masking spectrum by increment of 0,1 dB in each 1/3 octave band.
  - .4 An independent masking volume control providing minimum 0.1 dBA volume increments and an output range of 35 to 85 dBA @ 1m from the loudspeaker
  - .5 A temporary mute function for the masking output
  - .6 The ability to completely disable the masking output
  - .7 Possibility to provide a masking volume ramp-up function of up to 4 weeks to facilitate the introduction of the system in the buildings that are already occupied.
  - .8 The system shall provide a function to allow a gradual ramp up of masking volume each time power is applied
- .6 System control and software
  1. The configuration and the adjustment of the system shall be made with a PC or a tablet connected by a wireless connection. The wireless connection is required only during the configuration of the system.
  2. The sound masking system shall include graphical software interface that integrates the design, setup, and calibration stages directly on the office layout plan.
  3. When adjustment needs to be made on the sound masking system, the operator shall be able to make the changes directly from the area that needs modification. The operator control PC or tablet shall be able to communicate with the system by wireless.
- .7 Sound Masking Systems Acoustical Performance
  1. The preferred target sound masking frequency spectrum to be used shall be the one shown in Table 1 and in Acoustical Design of Conventional Open Plan Offices, Canadian Acoustics, vol 27, no. 3, 2003 (NRCC-46274) for each zone
    - .1 The frequency contour provided shall be maintained at different dBA target levels by equally applying the positive or negative difference, between the nominal 45 dBA level and the target dBA level, to each of the one-third octave frequency band's dB level, so as to equally shift the entire contour. (e.g. A target level of 42 dBA, will required shifting the entire 45 dBA spectrum down equally by 3 dB in each of the 1/3 octave frequency bands)

Table 1: Optimal Sound Masking Spectrum (ref. Bradley, NRCC-46274 report)

– Nominal 45 dBA Contour

1/3 Octave Band Center Frequency	1/3 Octave dB Sound Levels ( overall = 45 dBA nominal)
Hz	dB
100	42.5

125	42
160	41.5
200	41.5
250	41
315	40.5
400	39.5
500	38.5
630	37.5
800	37
1,000	35.5
1,250	33.5
1,600	31
2,000	28.5
2,500	26.5
3,150	23.5
4,000	21.5
5,000	19.5

2. Provide Adaptive volume control adjustment Workstations room 111
3. Masking sound levels for each location type shall be as follows:
  - .1 45 dBA in open plan areas.
  - .2 45 +/- 2 dBA in open areas with the adaptive volume control adjustment option.
  - .3 42 dBA in enclosed rooms
4. The supplier shall setup the sound masking system to meet acoustical performance requirements when HVAC systems are functioning under what is considered a "normal" mode of operation for occupied periods.
  - .1 It is the Departmental Representative's responsibility to ensure HVAC systems are operating as required during sound masking system's scheduled commissioning.
  - .2 The supplier shall not be responsible to meet acoustical performance requirements in locations where, existing background noise exceeds sound masking spectrum levels, and/or where building design details or other constraints prevent its proper installation, setup and operation.
5. The spectrum should be verified and adjust to match target spectrum for every 100 to 150 square meters in open area and in 20% of enclosed rooms. The measurement shall be performed at representative locations 1.5m above floor level 1m away from demising partitions and walls or large reflecting surfaces, in concordance with ASTM E1573 measurement procedures.
6. After adjustment, the system shall provide spatial uniformity within the tolerances provide below.
  - .1 Overall dBA levels measured within zones and in enclosed rooms shall be within +/- 1 dBA, of the specified target level for the combined mechanical and sound masking level.
  - .2 Uniformity in any third-octave band shall vary no more than +/- 2 dBA, from the 1/3 octave band contour levels indicated in Table 1.

- .3 In the situation where building background noise exceeds the target spectrum, special attention should be taken to identify the source.
- 7. To meet the above requirement, and allow flexible adjustments of the masking level, each 100 to 150 square meters of an open area should have an independent adjustment capability.
- 8. Upon completion of installation, and final setup the supplier shall provide a report to Departmental Representative of the sound masking systems acoustical performance.
- .8 Adaptive volume control adjustment in open areas
  - 1. The adaptive volume control system provides a real-time volume adjustment of the masking sound level based on the level of distracting noise in a zone.
  - 2. The ambient noise shall be measured with sensors installed in the ceiling.
  - 3. The adaptive adjustment system shall be based on the latest DSP technology
  - 4. Sensitivity of the active volume control shall be programmable to adapt masking level with ambient noise increase.
  - 5. Level variations rates shall be adjustable with 0.1dB steps, update every 15s.
  - 6. The minimum and maximum sound masking level and the sensitivity of the active volume control shall be programmable.
  - 7. It should be possible to control the masking sound volume in each zone independently.
  - 8. History of the active volume control shall be recorded on a 7 days period to allow the performance of the system to be analysed.
- .9 Timer Performance
  - 1. The system shall provide a timer function allowing masking volume levels to be automatically adjusted according to a programmed schedule
  - 2. The system shall provide a calendar-based programmable timer function. Timer schedules shall be assigned to an individual or group of sound masking zones.
- .10 In-Room occupant Control
  - 1. Provide 1 wall mounted, in-room controls as indicated on the plan giving the user's manual controls over the loudspeaker volume in designated room or zone.
  - 2. Provide device boxes and conduit up to accessible ceiling space.
- .11 Security Performance
  - 1. The system shall provide:
    - .1 Password-protected access to the project manager software.
    - .2 storage of settings in memory in each networked masking device, which shall be maintained during power outages

## 2.3. SUBMITTALS

- .1 Product Data: Manufacturer's specifications and installation instructions.
- .2 System Design: Schematics of the system showing quantity and location of components, related cabling and accessories.

- .3 Warranty Documents: Warranty documents covering the system components.

## 2.4. QUALITY ASSURANCE

- .1 System Design: Performed by an approved manufacturer representative.
- .2 Installer Qualifications: Approved by manufacturer representative and are trained with the specified components or have demonstrated experience with the installation of similar products to those specified.
- .3 System Adjustment: Done by an approved manufacturer representative or trained contractor.

## 2.5. REGULATORY TESTING AND CERTIFICATIONS

- .1 The relevant system components shall conform to:
  - 1. UL 60065 / ULC 60065 – Standard for Audio/Video and Musical Instrument Apparatus for Household, Commercial and Similar General
  - 2. FCC – EN 55103-1&2 – Audio, Video and Entertainment Lighting Control

## 2.6. WARRANTY AND MAINTENANCE

- .1 Provide a written warranty that the system components installed shall be free from defects in parts or assembly for a 5-year period from date of first use (the date of system initialization).

# Part 3 Execution

## 3.1 SYSTEM DESIGN

- .1 Design system according to manufacturer's specifications.

## 3.2 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for intercommunications systems installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of .
  - .2 Inform of unacceptable conditions immediately upon discovery.
  - .3 Ensure that facility build out is at a stage suitable for the system installation.
  - .4 Ensure that facility is constructed according to plans, including wall locations, ceiling types and plenum barriers.
  - .5 Ensure that the plenum height is appropriate as per manufacturer's recommendations and as per plan.
  - .6 Ensure power requirements have been provided as per plan.
  - .7 Ensure sufficient space for centrally located components is available as per plan and manufacturer's specifications.
  - .8 Ensure any third-party components required to be interfaced with the system have been provided.

- .9 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from .

### **3.3 PERMITS**

- .1 Obtain necessary permits for installation work.

### **3.4 INSTALLATION**

- .1 Install equipment as indicated and in accordance with manufacturer's instructions.
- .2 Interconnect system components.
- .3 Follow all applicable codes and standards for the area.
- .4 Follow manufacturer's recommendations regarding installation.
- .5 Follow the system design for location of loudspeakers and wiring.
- .6 Record any necessary changes to the system design on the plan.
- .7 Ensure that supplementary materials used meet applicable safety standards.

### **3.5 FIELD QUALITY CONTROL**

- .1 Ensure that loudspeakers are suspended in a level manner.
- .2 Minimize obstructions to loudspeakers, to the extent possible.
- .3 Ensure cables are properly supported in the ceiling.
- .4 Ensure cables are securely terminated.
- .5 Ensure cables are Plenum rated

### **3.6 SYSTEM CONFIGURATION AND ADJUSTMENT**

- .1 Follow manufacturer's recommendations for system settings as found in the User Manual.

### **3.7 DEMONSTRATION AND TRAINING**

- .1 Demonstrate operational system to the Departmental Representative by walking the space.
- .2 Demonstrate functionality of the system to the Departmental Representative.
- .3 Provide any training to the Departmental Representative that may be required under the terms of the contract to maintain and/or operate the system or any optional devices (e.g., in room controls)
- .4 Provide 2 hour training for users and 2 hour training for maintenance personnel.

### **3.8 TESTS**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Conduct intelligibility performance test.

**3.9 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.10 PROTECTION**

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

**END OF SECTION**



## **Part 1 General**

### **1.1 REFERENCES**

- .1 Abbreviations:
  - .1 Electronic Access Control (EAC): control of people through entrances and exits of controlled area. Security utilizing hardware systems and specialized procedures to control and monitor movements within a controlled area.
  - .2 CPVX: Central Station Burglar Alarm Systems.
  - .3 CVSG: Mercantile Burglar Alarm Systems.
  - .4 CVWX: Proprietary Burglar Alarm Systems.
  - .5 DRS: Door Release System.
  - .6 PIN: Personal Identification Number.
- .2 Reference Standards:
  - .1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
    - .1 Material Safety Data Sheets (MSDS).
  - .2 Underwriters Laboratories of Canada (ULC)
    - .1 CAN/ULC-S301-09, Standard for Signal Receiving Centre Burglar Alarm System and Operations
    - .2 CAN/ULC-S302-M91(R1999), Standard for Installation and Classification of Burglar Alarm Systems for Financial and Commercial Premises, Safes and Vaults.
    - .3 CAN/ULC-S304-06, Signal Receiving Centre and Premise Burglar Alarm Control Units.
    - .4 CAN/ULC-S310-M91(R1999), Installation and Classification of Residential Burglar Alarm Systems.
    - .5 ULC-S318-96, Standard for Power Supplies for Burglar Alarm Systems.
    - .6 ULC-C634-86, Guide for the Investigation of Connectors and Switches for Use with Burglar Alarm Systems.
  - .3 Underwriters' Laboratories (UL)
    - .1 UL 294-2009, Access Control System Units.
    - .2 UL 603-08, Power Supplies for Use with Burglar Alarm Systems.
    - .3 UL 681-1999, Installation and Classification of Burglar and Holdup Alarm Systems.
    - .4 UL 827-2008, Central-Station Alarm Services.
    - .5 UL 1023-2009, Household Burglar Alarm System Units.
    - .6 UL 1076-2005, Safety for Proprietary Burglar Alarm Units and Systems.
    - .7 UL 1641-1999, Safety for Installation and Classification of Residential Burglar Alarm Systems.

### **1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:

- .1 Submit manufacturer's instructions, printed product literature and data sheets for access controls and equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.
- .3 Submit:
  - .1 Functional description of equipment.
  - .2 Technical data for all devices.
  - .3 Device location plans and cable lists.
  - .4 Devices mounting location detail drawings.
  - .5 Typical devices connection detail drawings.
- .3 Shop Drawings:
  - .1 Shop drawings to indicate project layout, including details.
    - .1 Shop drawings to indicate, mounting heights and locations, wiring diagrams.
    - .2 Submit zone layout drawing indicating number and location of zones and areas covered.
    - .3 Submit wiring diagrams.
    - .4 Submit complete equipment list.
- .4 Samples:
  - .1 Submit for review and acceptance of each unit.
  - .2 Samples will be returned for inclusion into work.
  - .3 Submit 1 sample of each component proposed for inclusion into system. Components will be returned for incorporation into work.
- .5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .1 Submit ULC/UL Product Safety Certificates.
  - .2 Submit verification Certificate that service company is ULC/UL List alarm service company.
  - .3 Submit verification Certificate that security access system is "Certified alarm system".
- .6 Test and Evaluation Reports:
  - .1 Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .7 Manufacturer's Instructions: submit manufacturer's installation instructions.
- .8 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.
- .9 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

- .2 Submit Construction/Demolition Waste Management and Disposal in accordance with Section 01 74 21.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for access controls and equipment for incorporation into manual.
  - .1 Include:
    - .1 System configuration and equipment physical layout.
    - .2 Functional description of equipment.
    - .3 Instructions of operation of equipment.
    - .4 Illustrations and diagrams to supplement procedures.
    - .5 Operation instructions provided by manufacturer.
    - .6 Cleaning instructions.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements [with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect access controls and equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **1.5 WARRANTY**

- .1 For Access control equipment and materials the 12 month warranty period.
- .2 Manufacturer's Warranty: submit, for Departmental Representative's acceptance, manufacturer's standard warranty document executed by authorized company official.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Control Panel:
  - .1 Network Door Controller shall be an open, non-proprietary platform for access management that meets the requirements for advanced enterprise systems as well as smaller installations.

- .2 Shall use IP, standard IT equipment and Application Programming Interface (API).
- .3 Shall be scalable and future-proof solution that can easily integrate with other systems and components.
- .4 Network Door Controller shall have a built-in software for basic access management and is open for third-party software, allowing the unit to be integrated with solutions provided by other manufacturers.
- .5 The controller shall be a smart independent device that is installed by each door and data is automatically synchronized between the controllers in the system. It will continue its normal operation and buffer events locally if there is a network failure.
- .6 Supports Power over Ethernet, which eliminates the need for separate power cables to do or accessories and other proprietary data cable.
- .2 Include: equipment cabinet, equipment panels, system power supply and all the cables.
- .3 Provide system cables including multi-conductor control cable and AC power cable as required.
- .4 Up to 2 readers per controller (Wiegand, RS485 (OSDP)) with support for Indala Flexcard proximity card format.
- .5 Doors: 1–2 doors per controller
- .6 Credentials: Up to 15 000 with third-party access management software depending on server capacity
- .7 Event history: 30 000 First In, First Out (FIFO) per controller
- .8 Access schedules: Unlimited or third-party software dependent
- .9 I/O interface Reader I/O: DC output: 2x 12 V DC output max 300 mA; 2x 4 configurable inputs/outputs, (Digital input: 0 to max 40 V DC, Digital output: 0 to max 40 V DC, Open drain, max 100 mA) Reader data: RS485 full duplex, RS485 half duplex, Wiegand Auxiliary: 1x 3.3 V DC output, max 100 mA 2x configurable inputs/output (Digital input: 0 to max 40 V DC, Digital output: 0 to max 40 V DC, Open drain, max 100 mA) Door connectors: 2x 2 input for door monitors and REX (Digital input: 0 to max 40 V DC)
- .10 Password protection, IP address filtering, HTTPSb encryption, IEEE 802.1X network access control, Digest authentication, User access log
- .11 Supported protocols  
IPv4, HTTP, HTTPSb, TLSb, QoS Layer 3 DiffServ, FTP, SMTP, Bonjour, UPnP TM, SNMPv1/v2c/v3 (MIB-II), DNS, DynDNS, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS
- .12 Software Configuration and basic access control management through Internet Explorer, Firefox, Chrome, or Safari Supported languages: English, French, Italian, German and Spanish
- .13 Power Power in: 10–30 V DC, max 26 W or Power over Ethernet IEEE 802.3af/802.3at Type 1 Class 3 Power out & relay: 1x 12 V DC, max 500 mA 1x solid state relay 30 V DC, max 700 mA Power out lock: 2x 12 V DC, max 500 mA
- .14 Approvals EN 55022 Class B, EN 50130-4, EN 61000-3-2, EN 61000-3-3, EN 55024, EN 61000-6-1, EN 61000-6-2, FCC Part 15 Subpart B Class B, ICES-003 Class B, C-tick AS/NZS CISPR 22 Class B, VCCI Class B, IEC/EN/UL 60950-1, UL 294, UL 2043, EN 50581
- .15 Acceptable Product: Kantech KT-400 IP 4 door controller.
- .2 Card readers:

- .1 Type: Weigand proximity.
  - .2 Proximity technology.
  - .3 Communications: weigand/clock and data
  - .4 Fitted with LED indicator light.
  - .5 Reading distance 25 mm.
  - .6 Compatible with client access control hardware and existing reader technology.
  - .7 Card must be compatible with existing building card.
  - .8 Multi-Layered Security – Ensures data authenticity and privacy through the multilayered security of HID's SIO.
  - .9 EAL5+ Certified Secure Element Hardware – Provides tamper-proof protection of keys/cryptographic operations.
  - .10 SIO Data Binding – Inhibits data cloning by binding an object to a specific credential.
  - .11 Mobile device support using card emulation - Enables HID access control.
  - .12 SIO Portability – Provides technology independence and portability to other smart card technologies.
  - .13 Upgradeable Hardware Connection – Allows all Wiegand-based communication readers to expand communication capabilities to OSDP, Hi-O and other bidirectional protocols.
  - .14 Field Programmable Readers – Provides secure upgrades for migration and extended lifecycle.
  - .15 Customization and management from a central location – Enables organization to make changes and manage all attached OSDP readers over RS485 wiring.
  - .16 Simultaneous support for 125kHz HID Prox, Indala, AWID and EM4102.
  - .17 Allows for support of future technologies.
  - .18 Secured communications using OSDP with Secure Channel Protocol.
  - .19 Certification: UL294/cUL (US), FCC Certification (US), IC (Canada), CE (EU), C-tick (Australia, New Zealand), SRRC (China), MIC (Korea)<sup>4</sup>, NCC (Taiwan)<sup>4</sup>, iDA (Singapore)<sup>4</sup>, RoHS , FIPS-201 Transparent FASCON Reader
  - .20 Provide 150 proximity cards, cards to be compatible with client requirements, confirm type before ordering cards. Facility code shall be coordinated with Departmental Representative prior to ordering cards.
- .3 System Devices:
- .1 Door strike: latch monitor, UL approved complete with mounting hardware.
  - .2 Request to exit motion detector device:
    - .1 Infrared detection.
    - .2 Continuous low-voltage operation.
    - .3 Fitted with indicator light.
    - .4 Integrated with local audio alarm (electronic buzzer).
    - .5 Adjustable coverage.
  - .3 Power supplies:
    - .1 Continuous low-voltage operation output.

- .2 Equipped with secondary protection for each output.
- .3 Individual outputs for connection of devices.
- .4 AC power failure output.
- .5 DC power failure output and low battery output.
- .6 Fitted with tamper contact.
- .7 Wall mounted cabinet with locked door complete with 2 keys.
- .8 Voltage: Shall be able to supply power for both access control panel and electric strike.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for access control system installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 INSTALLATION: SECURITY ACCESS**

- .1 Install security access systems and components in accordance with CAN/ULC-S302 CAN/ULC-S310 .
- .2 Install components in accordance with manufacturer's written installation instructions to locations, heights and surfaces shown on reviewed shop drawings.
- .3 Install components secure to walls, ceilings or other substrates.
- .4 Install required boxes in inconspicuous accessible locations.
- .5 Conceal conduit and wiring.

### **3.3 SITE TEST AND INSPECTION**

- .1 Perform verification inspections and test in presence of Consultant.
  - .1 Provide all necessary tools, ladders and equipment.
  - .2 Ensure appropriate subcontractors and manufacturer's representatives and security specialists are present for verification.
  - .3 Ensure that the system is configured through the building Access control system.
- .2 Performance testing:
  - .1 Test procedure: perform test on a "go-no-go" basis.
    - .1 Make only operator adjustments required to show proof of performance.
    - .2 Test to demonstrate and verify that installed system complies with installation and technical requirements of this specification under operating conditions.

- .3 Test results to be evaluated by Consultant as either acceptable or unacceptable using following procedures.
  - .2 Documentation review:
    - .1 This review will determine if information provided is sufficient to meet requirements of this specification.
    - .2 Provide for review all System manuals, as installed drawings, pretest forms, equipment cabinet pictorial, video and audio equipment details.
  - .3 Mechanical inspection:
    - .1 Consultant and Contractor to tour areas to insure that Systems and Subsystems are installed in place for proof of performance testing.
    - .2 Take system inventory at this time. Verify following items before beginning proof of performance tests:
      - .1 Dust, debris, etc. are cleaned and removed from site.
      - .2 Equipment is properly labelled.
      - .3 Equipment identified in system's equipment lists are in-place and properly installed.
      - .4 Each System ground method are installed in accordance with manufacturer's instructions and this specification.
- .3 Subsystem functional test:
  - .1 Conduct operational testing after review of documentation and mechanical inspection completed. Proceed as follows.
    - .1 Perform operational test of each Subsystem to verify that all equipment is properly connected, interfaced and is functionally operational to meet requirements of this specification.
  - .2 Distribution or interface system:
    - .1 Check each door utilizing a volt/ohm (or signal level) meter to confirm each function and to insure that system meets all performance requirements.
  - .3 Total system test:
    - .1 Proceed with testing when system and subsystems are functionally tested and accepted. Total system tests to verify that requirements have been met for DC sub carrier, and control signals in accordance with this specification.
  - .4 Safety:
    - .1 Demonstrate with documentation that access control system meets safety requirements specified in UL 294.
- .4 Visual verification: objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:
  - .1 Sturdiness of equipment fastening.
  - .2 Non-existence of installation related damages.
  - .3 Compliance of device locations with reviewed shop drawings.
  - .4 Compatibility of equipment installation with physical environment.
  - .5 Inclusion of all accessories.
  - .6 Device and cabling identification.
  - .7 Application and location of ULC approval decals.

- .5 Technical verification: purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:
  - .1 Validate sensitivity of readers and applicability and application of cards.
  - .2 Connecting joints and equipment fastening.
  - .3 Compliance with manufacturer's specification, product literature and installation instructions.
- .6 Operational verification: purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:
  - .1 Operation of each device individually and within its environment.
  - .2 Operation of each device in relation with programmable schedule and or/specific functions.

### **3.4 FIELD QUALITY CONTROL**

- .1 Manufacturer Services:
  - .1 Manufacturer of products, supplied under this Section, to review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.
  - .2 Manufacturer's Field Services:
    - .1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product.
    - .2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
    - .3 Ensure manufacturer's representative is present before and during critical periods of installation and testing.
    - .4 Schedule site visits to review Work at stages listed:
      - .1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
      - .2 Twice during progress of Work at 25% and 60% complete.
      - .3 Upon completion of Work, after cleaning is carried out.

### **3.5 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove protective coverings from accessories and components.
  - .2 Clean housings and system components, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.
  - .3 Clean components free from dirt and fingerprints.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.



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

### **3.6 PROTECTION**

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

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S304-06, Signal Receiving Centre and Premise Burglar Alarm Control Units.
  - .2 CAN/ULC-S306-03, Intrusion Detection Units.
  - .3 ULC-S318-96, Standard for Power Supplies for Burglar Alarm Systems.
  - .4 ULC-C634-M1986, Guide for the Investigation of Connectors and Switches for Use with Burglar Alarm Systems.
- .3 Underwriters' Laboratories (UL)
  - .1 UL 603-08, Power Supplies For Use With Burglar-Alarm Systems.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for control panels, keypad, sensors and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.
  - .3 Submit:
    - .1 Functional description of equipment.
    - .2 Technical data for devices.
    - .3 Device location plans and cable lists.
    - .4 Devices mounting location detail drawings.
    - .5 Typical devices connection detail drawings.
- .3 Shop Drawings:
  - .1 Shop drawings to indicate project layout, mounting heights and locations, wiring diagrams, detection device coverage patterns, contact operating gaps, etc.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .1 Submit UL Product Safety Certificates.
  - .2 Submit verification Certificate that service company is ULC/UL List alarm service company.
  - .3 Submit verification Certificate that intrusion alarm system is Certified Alarm System.
- .5 Test and Evaluation Reports:

- .1 Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .6 Manufacturer's Instructions: submit manufacturer's installation instructions.
- .7 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Operation and Maintenance Data: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
  - .1 Include:
    - .1 System configuration and equipment physical layout.
    - .2 Functional description of equipment.
    - .3 Instructions of operation of equipment.
    - .4 Illustrations and diagrams to supplement procedures.
    - .5 Operation instructions provided by manufacturer.
    - .6 Cleaning instructions.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect intrusion detection from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **1.5 WARRANTY**

- .1 Manufacturer's Warranty: submit, for Departmental Representative's acceptance, manufacturer's standard warranty document executed by authorized company official.
  - .1 Include manufacturer/dealer recommendations, information and support services for 1 year.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Design Criteria:
  - .1 Design intrusion detection system using only ULC/UL listed products.

- .2 Design intrusion detection system using alarm service company specializing in intrusion detection systems.
- .3 Design intrusion detection system as a ULC/UL certified alarm system.
  - .1 Annunciating undesirable, abnormal or dangerous condition.
  - .2 Prioritizing alarms by alarm type; i.e. panic/duress, intrusion and tamper.
  - .3 Determining zone where alarm occurred.
  - .4 Annunciating power failure and power restoration.
  - .5 Annunciating low battery condition.
  - .6 Operate continuously for minimum period of 4 hours in the event of a power failure.
- .4 Use existing Alarm control panel located in 2nd floor East Electrical room coordinate exact location of alarm panel with Departmental Representative..
- .5 Relocate existing keypad, wireless transceiver and extend wiring to new location as indicated in the plan.
- .6 Keypad located in the main floor security area shall be kept connected to the alarm panel and operational.
- .2 Control Panel: ULC approved, expandable and designed for multiplexed expansion.
- .3 Detection Accessories:
  - .1 Passive Infrared Detectors/Microwave (PIR's): ULC approved, digital.
    - .1 Coverage pattern: minimum 18m, 90 degrees.
    - .2 Temperature requirement: 0 – 40 degrees Celsius.
    - .3 Tamper switch.
    - .4 Mounting: wall and ceiling.
  - .2 Glass break detector: ULC approved, complete with tamperproof switch and be designed to meet temperature and mounting requirements of project.
    - .1 Acceptable sensor based on "Tru Dual" Technology, superior combination of acoustic and seismic detection.
    - .2 Coverage pattern: 7.5m omnidirectional. Range is adjustable; no minimum range.
    - .3 Alarm Relay: Form C, 125mA max, 25VDC max
    - .4 Tamper Switch: Combination cover/wall tamper 25mA max, 24VDC max
    - .5 Alarm Duration: Five seconds (unaffected by alarm LED latching)
    - .6 ESD Immunity: 10kV discharges of either polarity to exposed surfaces
    - .7 Power Requirements: 6 - 18VDC, 12mA typical at 12VDC; 22mA max (Latched LED) AC ripple: 4V peak-to-peak at nominal 12VDC
    - .8 RFI Immunity: 30V/m, 10MHz - 1000MHz
    - .9 Operating Temperature: -10° to 50° C
    - .10 Approvals and Listings
    - .11 FCC and IC verified
    - .12 CE
    - .13 C-Tick
    - .14 UL/ULC Listed.
  - .3 Door Contacts : ULC approved.
    - .1 Mounting: concealed.

- .2 Mounting locations: door.
  - .3 Operating gap: 25 mm.
  - .4 Security level: high security
  - .5 Type: magnetic balanced.
  - .6 Colour identical throughout the installation.
  - .7 Provide separate and independent contacts for intrusion
  - .8 Sensors shall be installed as close as possible to the leading edge of the door, as a minimum an alarm shall be generated when door movement exceeds 25mm
  - .9 UL/ULC approved
- .4 **DURESS PUSH BUTTON**
- .1 The unit consists of a housing that contains the electrical circuitry and magnetic reed contacts, a cover plate to protect the internal electronics and an actuating lever with an Alnico V magnet installed in a cradle in the lever. When the lever is fully closed, the magnet — in proximity to the reed — triggers the circuit. The alarm occurs when the actuating lever is moved 20° to 45° past the fully closed position (approximately 1" from the fully closed position). On the latching models, an LED on the unit flashes and latches when the lever is opened. It can be reset only at the alarm panel.
  - .2 Nominal Voltage: 12 V DC @ 6 mA
  - .3 Current: Max 8 mA
  - .4 Operational Voltage: 7 V DC to 15 V DC
  - .5 Temperature Range: 0° to 110°F (-17.8°C to 43.3°C)
  - .6 Dimensions: 1.77" W x 2.90" L x 0.76" H (4.50 cm W x 7.37 cm L x 1.93 cm H)
  - .7 Weight: 1.5 oz.
  - .8 Housing Material: ABS plastic
  - .9 Form C: Voltage: 30 V
  - .10 DC max.Current: 0.25 A max.
  - .11 Power: 3 W m
- .5 Communications: use existing telephone system.
- .6 Connectors and switches: to ULC-C634.
- .7 Power supplies: to ULC-S318 UL 603.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for intrusion detection installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Consultant.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

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

### **3.2 INSTALLATION**

- .1 Install panels, intrusion detection system and components in accordance with manufacturer's written installation instructions to locations, heights and surfaces shown on reviewed shop drawings.
- .2 Install panels, intrusion detection system and components secure to walls, ceilings or other substrates.
- .3 Install required boxes in inconspicuous accessible locations.
- .4 Conceal conduit and wiring.

### **3.3 SITE TEST AND INSPECTION**

- .1 Perform verification inspections and test in the presence of Departmental Representative and Consultant.
  - .1 Provide necessary tools, ladders and equipment.
  - .2 Ensure appropriate subcontractors , and manufacturer's representatives and security specialists are present for verification.
- .2 Visual verification: objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual inspection to include:
  - .1 Sturdiness of equipment fastening.
  - .2 Non-existence of installation related damages.
  - .3 Compliance of device locations with reviewed shop drawings.
  - .4 Compatibility of equipment installation with physical environment.
  - .5 Inclusion of all accessories.
  - .6 Device and cabling identification.
  - .7 Application and location of ULC approval decals.
- .3 Technical verification: purpose to ensure that all systems and devices are properly install and free of defects and damage. Technical verification includes:
  - .1 Measurements of coverage patterns
  - .2 Connecting joints and equipment fastening.
  - .3 Compliance with manufacturer's specification, product literature and installation instructions.
- .4 Operational verification: purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:
  - .1 Operation of each device individually and within its environment.
  - .2 Operation of each device in relation with programmable schedule and or/specific functions.

### **3.4 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product.

- .2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Ensure manufacturer's representative is present before and during testing.
- .4 Schedule site visits to review Work at stages listed:
  - .1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.
  - .2 Twice during progress of Work at 25% and 60% complete.
  - .3 Upon completion of Work, after cleaning is carried out.

### **3.5 ADJUSTING**

- .1 Adjust all components for correct function.

### **3.6 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove protective coverings from accessories and components.
  - .2 Clean housings and system components, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.7 PROTECTION**

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

**END OF SECTION**

**Part 1 General**

**1.1 Related Requirements**

- .1 This Section covers items common to Sections of Divisions 26 and 28. These Sections supplement requirements of Division 1.

**1.2 References**

- .1 Treasury Board of Canada Secretariat (TBS), Occupational Safety and Health (OSH)
  - .1 Fire Protection Standard-10.
- .2 Underwriter's Laboratories of Canada (ULC)
  - .1 CAN/ULC-S524-06, Standard for the Installation of Fire Alarm Systems.
  - .2 CAN/ULC-S526-07, Visible Signal Devices for Fire Alarm Systems, Including Accessories.
  - .3 CAN/ULC-S527-99, Standard for Control Units for Fire Alarm Systems.
  - .4 CAN/ULC-S528-05, Manual Stations for Fire Alarm Systems, Including Accessories.
  - .5 CAN/ULC-S529-09, Smoke Detectors for Fire Alarm Systems.
  - .6 CAN/ULC-S530-91(R1999), Heat Actuated Fire Detectors for Fire Alarm Systems.
  - .7 CAN/ULC-S531-02, Standard for Smoke Alarms.
  - .8 CAN/ULC-S537-04, Standard for the Verification of Fire Alarm Systems.

**1.3 Action And Informational Submittals**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for multiplex fire alarm system and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Indicate on shop drawings:
    - .1 Details for devices.
    - .2 Details and performance specifications for control, annunciation and peripherals with item by item cross reference to specification for compliance.
    - .3 Step-by-step operating sequence, cross referenced to logic flow diagram.

**1.4 Closeout Submittals**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for fire alarm system for incorporation into manual.
- .3 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.

## **1.5 Maintenance Material Submittals**

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

## **1.6 Delivery, Storage And Handling**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 Description**

- .1 Existing Fire Alarm System
- .2 System to include:
  - .1 Initiating/input circuits.
  - .2 Output circuits.
  - .3 Auxiliary circuits.
  - .4 Wiring.
  - .5 Manual and automatic initiating devices.
  - .6 Audible and visual signalling devices.
  - .7 End-of-line resistors.
- .3 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.
- .4 Audible signal devices: to CAN/ULC-S524.
- .5 Visual signal devices: to CAN/ULC-S526.
- .6 Manual pull stations: to CAN/ULC-S528.
- .7 Thermal detectors: to CAN/ULC-S530.
- .8 Smoke detectors: to CAN/ULC-S529.
- .9 Smoke alarms: to CAN/ULC-S531.

- .10 Regulatory Requirements:
  - .1 To TBS Fire Protection Standard.
  - .2 Subject to Fire Commissioner of Canada (FC) approval.
  - .3 Subject to FC inspection for final acceptance.
  - .4 System components: listed by ULC and comply with applicable provisions of NBC, Local, Provincial Building Code and meet requirements of local authority having jurisdiction.

## **2.2 System Operation: Single Stage (Existing)**

- .1 Actuation of any alarm initiating device 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 remote annunciator display.
  - .3 For low rise buildings:
    - .1 Cause audible devices throughout building to sound at 20 strokes per minute.
    - .2 Cause audible devices in zone of alarm to sound continuously while other audible devices throughout building sound at 20 strokes per minute.
  - .4 Cause audible signalling devices to sound in alarm tone throughout building.
- .2 Acknowledging alarm: indicated at central control unit.
- .3 Ensure that it is possible to silence signals by "alarm silence" switch at central control unit, after 60 seconds period of operation.
- .4 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.
- .5 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 display.
  - .3 Cause audible signal at central control unit to sound.
  - .4 Activate common supervisory sequence.
- .6 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.
- .7 Troubles on system: suppressed during course of alarm.
- .8 Trouble condition on any circuit in system not to initiate alarm conditions.

## **2.3 Wiring**

- .1 Twisted copper conductors: rated 300 V.

- .2 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.
- .3 To signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.
- .4 To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

## **2.4 Manual Alarm Stations**

- .1 Manual alarm stations: pull lever, glass rod, wall mounted semi-flush type, non-coded single pole normally open contact for single stage bilingual signage.
- .2 Addressable manual pull station.
  - .1 Pull lever, break glass rod, semi-flush wall mounted type, single action, single 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.

## **2.5 Automatic Alarm Initiating Devices**

- .1 Heat detectors, fixed temperature, rated 57 degrees C.
- .2 Thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57 degrees C, rate of rise 8.3 degrees C per minute.
- .3 Addressable thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57 degrees C, rate of rise 8.3 degrees C per minute.
  - .1 Electronics to communicate detector's status to addressable module/transponder.
  - .2 Detector address to be set on detector base in field.
- .4 Smoke detector: ionization/photo-electric type and air duct type with sampling tubes with protective housing.
  - .1 Twistlock Plug-in type with fixed base.
  - .2 Wire-in base assembly with integral red alarm LED.
- .5 Addressable smoke detector.
  - .1 Ionization/Photo-electric type.
  - .2 Electronics to communicate detector's status to addressable module/transponder.
  - .3 Detector address to be set on detector base in field.
- .6 Addressable variable-sensitivity smoke detectors.
  - .1 Ionization/Photo-electric type.
  - .2 Electronics to communicate detector's status to addressable module/transponder.
  - .3 Detector address to be set on detector base in field.

- .4 Sensitivity settings: 7 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.

## **2.6 Audible Signal Devices**

- .1 Surface mounted, single stroke, polarized, 24 V dc, 250 mm, 79 db.

## **2.7 Visual Alarm Signal Devices**

- .1 Strobe type: flashing, red, 24 V dc.
- .2 Designed for surface mounting on walls.

## **2.8 End-Of-Line Devices**

- .1 End-of-line devices to control supervisory current in signalling circuits, sized to ensure correct supervisory current for each circuit. Open 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.

## **2.9 As-Built Riser Diagram**

- .1 Fire alarm system riser diagram: in glazed frame minimum size 600 x 600 mm.

## **2.10 Ancillary Devices**

- .1 Remote relay unit to initiate fan shutdown.

# **Part 3 Execution**

## **3.1 Examination**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for fire alarm installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

## **3.2 Installation**

- .1 Install systems in accordance with CAN/ULC-S524.
- .2 Install manual alarm stations and connect to alarm circuit wiring.
- .3 Locate and install detectors and connect to alarm circuit wiring. Mount detectors more than 1 m from 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.

- .4 Connect alarm circuits to main control panel.
- .5 Install bells and visual signal devices and connect to signalling circuits.
- .6 Connect signalling circuits to main control panel.
- .7 Install end-of-line devices at end of alarm and signalling circuits.
- .8 Install remote annunciator panels and connect to annunciator circuit wiring.
- .9 Install door releasing devices.
- .10 Install remote relay units to control fan shut down.
- .11 Sprinkler system: wire alarm and supervisory switches and connect to control panel.
- .12 Room detection system.
  - .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.
- .13 Connect fire suppression systems to control panel.
- .14 Splices are not permitted.
- .15 Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and CCU, as required by equipment manufacturer.
- .16 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.
- .17 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.

### **3.3 Field Quality Control**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and CAN/ULC-S537.
- .2 Fire alarm system:
  - .1 Test such device and alarm circuit to ensure manual stations, thermal, smoke detectors transmit alarm to control panel and actuate general alarm.
  - .2 Check annunciator panels to ensure zones are shown correctly.
  - .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of systems.
  - .4 Addressable circuits system style DCLA:
    - .1 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals on each side of single open-circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.
    - .2 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near midmost point of each link. Operate

Acknowledge/Silence switch after reception of each of the 3 signals.  
Correct imposed fault after completion of each series of tests.

- .5 Addressable circuits system style DCLB:
  - .1 Test each conductor on all DCLB addressable links for capability of providing 3 or more subsequent alarm signals on line side of single open-circuit fault condition imposed near electrically most remote device on each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.
  - .2 Test each conductor on all DCLB addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near electrically most remote device on each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.
- .3 Provide final PROM program re-burn for system Departmental Representative incorporating program changes made during construction.

### **3.4 Cleaning**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.


### **3.5 Protection**

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

### **3.6 Closeout Activities**

- .1 Provide on-site lectures and demonstration by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

**END OF SECTION**

		<b>FORM</b>	
<b>Form Title</b>	Building OHS Plan	<b>Number:</b>	HS 287-01 RP1
<b>Author:</b>	HSE Manager	<b>Effective Date:</b>	May 4, 2015
<b>Owner:</b>	HSE Director	<b>Revision:</b>	2

### Acknowledgement Notification

**Building(s):** \_\_\_\_\_

**Service provided:** \_\_\_\_\_

**Company name:** \_\_\_\_\_

I acknowledge that I have read and understand the following documents:

- **Brookfield GIS Site Specific Protocol**
- **Brookfield GIS Facility Site Specific Hazard Assessment**
- **Brookfield GIS Contractor Handbook**

I will communicate these documents to all my employees and sub-contractors. I will abide by the rules and regulations stated in these documents. I shall also abide by the Occupational Health & Safety Act, Industrial Regulations 851, as well as all other pertaining regulations and required permits (i.e. window washer Regs.)

Contractor/Service Provider:	
Contact Number:	
Supervisor's Name:	Tel. No:
Supervisor's Contact Number:	
Location(s) of Work:	
Signature:	Date:

**If Required:**

**Sub-Contractor Name:** \_\_\_\_\_


**Representative's Name:** \_\_\_\_\_ **Cell:** \_\_\_\_\_

**Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Sub-Contractor Name:** \_\_\_\_\_

**Representative's Name:** \_\_\_\_\_ **Cell:** \_\_\_\_\_

**Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_

		<b>FORM</b>	
<b>Title</b>	Project Hazard Assessment and Controls	<b>Project Name and Number</b>	
<b>Company Name</b>		<b>Person Completing</b>	

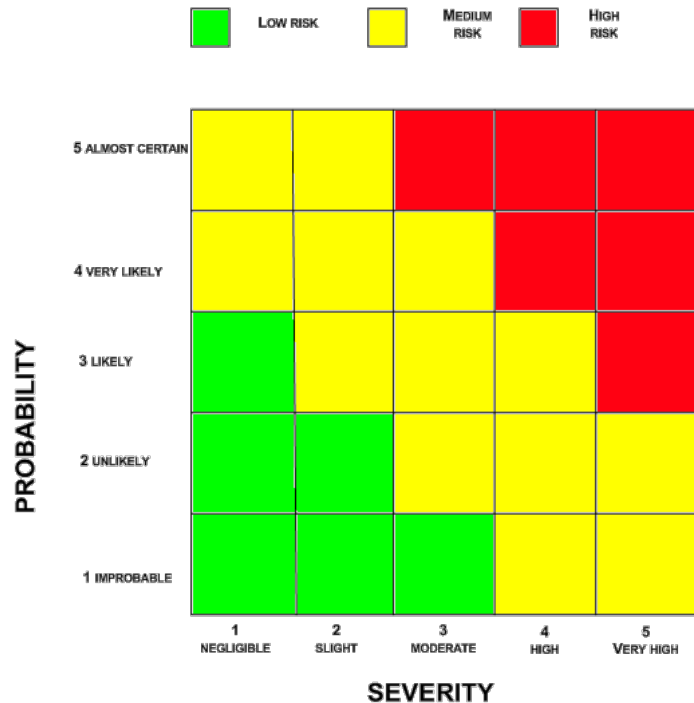
### Identification of Hazards and Controls

- Building-related hazards and controls can be reviewed via the Brookfield GIS Site Hazard Station as described in the Building OHS plan.
- Hazards and controls specific to this project have been outlined here. (see table starting next page)

### Hazard Assessment and Controls

All identified hazards must be posted at the work site. These must also be communicated to the JHSC or Safety Rep and all workers that may encounter those hazards during the course of their work.

### Risk Matrix



Key Risks:
1. Ex. Exposure to Noise
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.





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## Project Initiation and Inspection

All work associated with this project will be subject to regular inspection by the Brookfield GIS Senior Project Manager, and the Brookfield GIS Construction Safety Coordinator. While Brookfield GIS maintains oversight in the role of Constructor, contractors remain obligated to provide adequate supervision and continue to conduct their own inspections of the work as required of all employers under the regulations.

Please validate that each item noted is in place and will remain in place for the duration of the project.

### Project Initiation & Inspection Checklist

			General Safety
Yes	No	N/A	A Safety Board has been installed at the worker entrance to the project site. Safety board includes all items mandated under the regulations, as well as a copy of the regulations.
Yes	No	N/A	Notice of Project has been posted at the project site (includes project description, emergency telephone numbers, location and address, as well as any known or unique hazards)
Yes	No	N/A	All access points to the construction area have been clearly identified with signage posted. Access Control is in place, and PPE requirements have been posted.
Yes	No	N/A	Pre-Construction and weekly coordination meetings will be hosted by Senior Project Manager (Constructor), and at minimum will be attended by Construction Safety Coordinator, the Property Manager (OHS Control Authority), the HSE Coordinator (representing the interests of the tenants and Brookfield GIS Property Manager) a representative from all major contractors, representatives for each of the tenants.
Yes	No	N/A	Emergency procedures & plans have been posted on the safety board and will be reviewed with team members and contractors as appropriate (at least once at project kickoff and reviewed in each progress meeting to ensure no changes are required)
Yes	No	N/A	There are adequate First Aid Kits and Qualified First Aiders
Yes	No	N/A	Location, schedule and minutes of safety meetings, tool box talks and safety inspections will be posted on the project safety board.
Yes	No	N/A	The Brookfield GIS Work Permit is in place and associated requirements are met.
Yes	No	N/A	All supplemental permits (hot work, confined space entry, lock out/tag out, etc.) have been explained and are in place.
Yes	No	N/A	The location of the on-site Brookfield GIS Hazard Station has been communicated to all workers with instruction to review all hazards and controls prior to the start of any work.
Yes	No	N/A	MSDS for all hazardous materials that will be used on the project have been provided to the BGIS project manager; liquid containers and cylinders are labelled and stored properly, and a Designated Substances Report has been provided to all subcontractors.
Yes	No	N/A	All work involving excessive noise or strong odours will be scheduled to minimize disruption to the tenant and occupant activities.

Yes	No	N/A	Boilers and Pressure vessels will not be touched or interfered with by the project team. Senior Project Manager will interface with qualified representatives of the Property Management team relative to any requirements.
Yes	No	N/A	Project elements that require approval from a regulator or a professional engineer have been identified.
Yes	No	N/A	Arrangements have been made to ensure that all work areas continue to have adequate lighting.
			<b>Contractors and Subcontractors</b>
Yes	No	N/A	All Contractors (and subcontractors) have been verified as having good safety records and remain in good standing with provincial workers compensation board.
Yes	No	N/A	Contractor has a comprehensive safety program meeting at minimum legislated requirements.
Yes	No	N/A	Contractors (and subcontractors) have received orientation to Brookfield GIS safety procedures and reviewed and signed Brookfield GIS Contractor Safety Handbook is on record for every contract company working on the project.
Yes	No	N/A	All contractor and subcontractor workers have completed the Brookfield GIS Site , and Project-Specific Orientation
Yes	No	N/A	All contractors and subcontractors have been informed of the requirement to report all hazardous occurrences, unsafe conditions and incidents to Brookfield GIS, as well as forward copies of any orders and or directives issued by the Authority Having Jurisdiction to Brookfield GIS.
Yes	No	N/A	An adequate level of competent supervision will be provided relative to each contractor or subcontractor.
Yes	No	N/A	Construction material staging and storage requirements/limitations have been communicated to all contractors.
			<b>Fire Prevention</b>
Yes	No	N/A	Fire protection systems will be maintained or a fire watch will be maintained throughout the work.
Yes	No	N/A	Firefighting equipment appropriate to the work will be accessible, and will be maintained at all times in good repair.
Yes	No	N/A	Hot Work permits are available and will be used when required.
			<b>Fall Protection and Confined Space</b>
Yes	No	N/A	All confined spaces (existing or that will be created as a result of the work activity) have been clearly identified with warning signage.
Yes	No	N/A	All workers performing confined space entry are certified and have all necessary equipment, properly calibrated tools, plans and permits.
Yes	No	N/A	All holes or openings have been barricaded or covered securely and marked
Yes	No	N/A	Those working above 2m (6ft) off the ground, within 2m (6ft) of a roof edge, on any sloped roof or within 2m (6ft) of an opening they could fall through are protected by a guardrail, covering or personal fall arrest system. (in tender docs)
Yes	No	N/A	Fall protection equipment will be worn and tied off at all times on any elevated work platforms or scaffolding.
Yes	No	N/A	Personal fall protection devices and equipment will be inspected prior to each use by a competent person and worker fall protection certification will be verified.
			<b>Trenching, Excavation and Tunneling</b>
Yes	No	N/A	A notice of dig and permit number has been issued by the provincial authority if appropriate.
Yes	No	N/A	If no support system will be in use relative to excavation work, documented opinion from a Professional Engineer is available.

Yes	No	N/A	Support System design drawings and specifications are available
Yes	No	N/A	All excavations will be appropriately barricaded.
			<b>Elevating Devices/Hoisting Workers</b>
Yes	No	N/A	Any repair, alteration or modification of an elevating device will be a certified elevating device mechanic. Elevators will be parked with doors open, barricades in place and signage at each floor whenever work is in progress.
Yes	No	N/A	Notification has been made to the provincial authority if required before any hoisting operations takes place if workers will be raised, supported or lowered by a crane.
Yes	No	N/A	Relative the preceding item, design drawings and certification documents are available.
			<b>Housekeeping</b>
Yes	No	N/A	All construction debris will be kept clear from egress, work areas, hallways and stairways.
Yes	No	N/A	Barricades, signage and spill kits are available where necessary. All liquid spills will be barricaded/cleaned-up immediately
Yes	No	N/A	Established walking paths will be kept clear of loose electrical cords, excess equipment, and other trip hazards.
Yes	No	N/A	Appropriate dust control such as hoarding, and dust-capture systems will be used where appropriate.
Yes	No	N/A	Electrical and mechanical rooms will not to be used as storage space and will be kept clear at all times.
			<b>Electrical</b>
Yes	No	N/A	Only authorized/certified electricians will be performing electrical work
Yes	No	N/A	All work parties are trained in lock-out/tag-out procedures
Yes	No	N/A	NO LIVE WORK will be permitted. All equipment will be properly locked out/tagged out prior to the start of the work.
Yes	No	N/A	All temporary lighting will be equipped with guards to prevent contact with the bulb
Yes	No	N/A	Electrical junction boxes will be closed
Yes	No	N/A	Electrical cords will be kept in good repair and will be removed from use if frayed, cut or nicked.
Yes	No	N/A	Any modification to building electrical systems will include updated labeling to the breaker panels.
Yes	No	N/A	All electrical installations will be grounded or double insulated.
			<b>Stairways, Ladders and Scaffolds</b>
Yes	No	N/A	Staircases with more than 4 steps will be equipped with handrails
Yes	No	N/A	If used to access the roof, extension ladders will exceed by at least 1m (3ft) of the roof edge.
Yes	No	N/A	Extension ladders, when in use, will be inclined at a ratio of 4:1
Yes	No	N/A	All ladders and step ladders will be in good repair, and inspected prior to use
Yes	No	N/A	Extension ladders having a risk of sliding or being struck are securely tied off barricaded.
Yes	No	N/A	Ladders will not to be used within 3m (10ft) of electrical power lines
Yes	No	N/A	Scaffolds are in good repair and working surface is fully planked
Yes	No	N/A	Design drawings and load capacity, and engineering sign-off for scaffolding is available where applicable
Yes	No	N/A	Competent person has certified installation of all scaffolds prior to the start of work
			<b>Hand &amp; Power Tools</b>
Yes	No	N/A	All hand and power tools will be inspected prior to use and in good working order

Yes	No	N/A	All safety guards and devices will be in place while the tools are in use
			<b>Vehicle and Mobile Equipment</b>
Yes	No	N/A	All equipment operators are properly authorized, trained and certified
Yes	No	N/A	Construction equipment and vehicles are parked so as to prevent the release of stored energy (bucket/forks down, brake applied, wheels chocked)
Yes	No	N/A	Signallers are used if the operator has an obstructed view in order to protect other vehicles or pedestrians
Yes	No	N/A	Special care is taken when operating heavy equipment near power lines
			<b>Sanitation on construction site</b>
Yes	No	N/A	Toilets and an adequate supply of potable water are provided at the jobsite and location is posted at the job site
Yes	No	N/A	Records of maintenance for portable toilets are posted at the job site