

PWGSC ONTARIO	SPECIFICATION	SECTION 00 00 00
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Project Title PUBLIC WORKS GOVERNMENT SERVICES CANADA  
ENVIRONMENT CANADA  
185 OUELLETTE AVEUNE  
WINDSOR, ONTARIO

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PART 1 - GENERAL

1.0 SECTION INCLUDES

- .1 Minimum Standards
- .2 Authorities Having Jurisdiction
- .3 Safety Plans for Work Orders
- .4 Taxes
- .5 Fees, Permits, Certificates and Letters
- .6 Examination
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- .32 Halocarbons
- .33 Special Protection and Precautions
- .34 IAQ - Indoor Air Quality
- .35 Pollution Control
- .36 OPSS and OPSD
- .37 Security
- .38 Metric Sized Materials

## 1.1 MINIMUM STANDARDS

Execute work to meet or exceed:

- .1 National Building Code of Canada 2010, National Fire Code of Canada 2010, Ontario Building Code 2012 and any other code of provincial or local application, including all amendments up to project date, provided that in any case of conflict or discrepancy, the more stringent requirements shall apply as directed by the Departmental Representative.
- .2 Rules and regulations of authorities having jurisdiction.
- .3 Treasury Board of Canada Secretariat, Fire Protection Standard, April 1, 2010.
- .4 Observe and enforce construction safety measures required by National Building Code 2010, Part 8 Safety Measures at Construction and Demolition Sites, Occupational Health and Safety Act and Regulations for Construction Projects, Revised Statutes of Ontario 1990, Chapter O.1 as amended, O. Reg. 213/91 as amended by O. Reg. 631/94, O. Reg. 143/99, O. Reg. 571/99, O. Reg. 145/00, O. Reg. 527/00, R.R.O. 1990, Reg. 834, O. Reg. 278/05 (Asbestos), Workplace Safety and Insurance Board and municipal statutes and authorities.
- .5 Environmental Protection Act, O. Reg. 102/94 and O. Reg. 103/94.

## 1.2 AUTHORITIES HAVING JURISDICTION

- .1 Fire Testing requirements are for ULC or WHI listed and labelled products.
- .2 Substitution of ULI or other Fire testing reports for required ULC and WHI testing is acceptable to the Departmental Representative only if the issuing organization is accredited and listed in the "Directory of Accredited Certification Organizations (CAN-P-1505C), 1993" published by the Standards Council of Canada, 1-800-267-8220. Testing shall be to the Canadian standards and the tested products shall bear the appropriate label.
- .3 Submit 3 copies of test reports under the letterhead of the accredited organization to the Departmental Representative.

## 1.3 SAFETY PLANS FOR WORK ORDERS

- .1 Provide a Fire Safety Plan, specific to the work location, in accordance with NBC 2010, Division B, Part 8, Article [8.1.1.3] [8.1.1.1] and NFC 2010, Division B, Part 2, subsection 2.8.2 prior to commencement of work. The plan shall be coordinated with, and integrated into, the existing [Building, Facility, Tenant's] Emergency Procedures and Evacuation Plan in place at the site. Departmental Representative will provide [Building, Facility, Tenant's] Emergency Procedures and Evacuation Plan. Deliver two copies of the Fire Safety Plan to the Departmental Representative not later than 14 days before commencing work.
- .2 On award of Contract, submit to Departmental Representative, two copies of Contractor's and sub-contractors':
  - .1 Site Specific Safety Plan.
  - .2 Safety Communication Plan.
  - .3 Emergency Procedures Plan.
  - .4 WSIB - Workplace Safety and Insurance Board Experience report.

#### 1.4 TAXES

- .1 Pay applicable Federal, Provincial and Municipal taxes.

#### 1.5 FEES, PERMITS, CERTIFICATES AND LETTERS

- .1 Provide authorities having jurisdiction with information requested.
- .2 Pay fees and obtain certificates, permits and letters required.
- .3 Obtain 'Permit to Work Form' from PWGSC.
- .4 Obtain PWGSC Fire Protection Engineer Inspection Letter of Deficiencies from Departmental Representative. Submit a copy of the letter with a list of remedial measures taken to correct deficiencies.
- .5 Furnish certificates, permits and letters when requested.
- .6 Obtain receipt from carpet manufacturer for existing carpet returned for recycling and submit to Departmental Representative with request for final payment.

#### 1.6 EXAMINATION

- .1 Examine existing conditions and determine conditions affecting work.

#### 1.7 DOCUMENTS

- .1 Keep one hard copy of contract documents on the site.
- .2 Ensure applicable items, articles, notices and DOCUMENTS orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province of Ontario, and in consultation with Departmental Representative.
  - .1 Contractor's Safety Policy.
  - .2 Constructor's Name.
  - .3 Notice of Project.
  - .4 Name, trade, and employer of Health and Safety Representative or Joint Health and Safety Committee members (if applicable).
  - .5 Ministry of Labour Orders and reports.
  - .6 Occupational Health and Safety Act and Regulations for Construction Projects for Province of Ontario.
  - .7 Address and phone number of nearest Ministry of Labour office.
  - .8 Material Safety Data Sheets.
  - .9 Written Emergency Response Plan.
  - .10 Site Specific Safety Plan.
  - .11 Valid certificate of first aider on duty.
  - .12 WSIB "In Case of Injury At Work" poster.
  - .13 Location of toilet and cleanup facilities.

## 1.8 ELECTRONIC SUBMITTALS

- .1 Submit number of hard copies specified for each type and format of submittal and also submit in electronic format as pdf files. Forward pdf, NMSEdit Professional spp, MS Word, MS Excel and Autocad dwg files; on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as Oproma, as directed by Departmental Representative.

## 1.9 CONTRACTOR'S AS-BUILT DRAWINGS AND SPECIFICATIONS

- .1 As work progresses, neatly record significant deviations from the Contract drawings and specifications using fine, red marker on full size white prints and specifications. Make the same changes on the electronic files.
- .2 Neatly print lettering and numbers in size to match original. Lines may be drawn free-hand but shall be neat and accurate. Add at each title block note: "AS BUILT". Also circle on List of Drawings each title and number of drawing marked with "AS-BUILT" information. Circle on Table of Contents each specification section number and title of specification sections marked with "AS-BUILT" information.
- .3 Departmental Representative will provide one electronic set of drawings, schedules and specifications for as-built drawing and specification purposes.
  - .1 Drawings are in Autocad.
  - .2 Specifications are in NMSEdit Professional or MS Word.
  - .3 Amendments and addenda are in MS Word.
- .4 Record following significant deviations:
  - .1 Depths of various elements of foundation.
  - .2 Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvement.
  - .3 Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.
  - .4 Field changes of dimension.
  - .5 Other significant deviations which are concealed in construction and can not be identified by visual inspection.
  - .6 Alternative materials and systems installed replacing original materials and systems specified by trade name.
- .5 Turn one set, paper copy and electronic copy, of AS-BUILT drawings and specifications over to Departmental Representative on completion of work. Submit pdf files on USB compatible with PWGSC encryption requirements, through email or alternate electronic file sharing service such as ftp.
- .6 If project is completed without significant deviations from Contract drawings and specifications submit to Departmental Representative one set of drawings and specifications marked "AS-BUILT".

#### 1.10 OPERATIONS AND MAINTENANCE DATA

- .1 On completion of project submit to Departmental Representative 3 copies of Operations and Maintenance Data assembled in three 255 x 295 mm vinyl-covered, 3-ring, loose-leaf binders with title sheet labelled "Operations Data and Maintenance Manual", project title, date and list of contents. Organize content into applicable sections between hard paper dividers with labelled tabs.
- .2 Include in each binder maintenance instructions for finished surfaces, warranties and guarantees in form approved by Departmental Representative and operations and maintenance data for equipment and systems with parts list, suppliers' names and addresses, hardware schedule, schematic diagrams for electrical hardware, complete set of final shop drawings (bound separately), names, addresses and phone numbers of sub-contractors and suppliers, list of materials with names of manufacturer and source of supply. Neatly type lists and rates. Use clear drawings, diagrams or manufacturer's literature.

#### 1.11 SHOP DRAWINGS AND PRODUCT DATA SHEETS

- .1 Prior to submission check and certify as correct, shop drawings and product data sheets. Issue to Departmental Representative each submission at least 14 days before dates reviewed submission will be needed.
- .2 Where technical sections specify that shop drawings bear the stamp of a Registered Professional Engineer, the Engineer must be registered in the Province of Ontario.
- .3 Submit 3 prints and 1 electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .4 Submit 3 prints and 1 electronic copy 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.
- .5 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept. 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 all requirements of construction and Contract Documents. 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 all sub-trades.

- .6 Submit 3 prints and 1 electronic of product data sheets for standard manufactured items. Indicate VOC's in g/l for adhesives, primers, sealants, paints, curing and sealing compounds, sealers, particleboard, plywood, preserved wood, and any other product that emits more than 25 g/l VOC during application, curing, initial off gassing or end use.
- .7 Responsibility for errors, omissions or deviations from requirements of Contract Documents is not relieved by Departmental Representative's review of submittals.

#### 1.12 CONSTRUCTION PHOTOGRAPHS

- .1 Submit electronic and hard copy of colour digital photography in jpg format, fine resolution.
- .2 Identification: name and number of project and date of exposure indicated.
- .3 Viewpoints and location of viewpoints determined by Departmental Representative.
- .4 Frequency: at completion of: framing and services before concealment and as directed by Departmental Representative.

#### 1.13 DESIGN DATA, TEST REPORTS, CERTIFICATES, MANUFACTURER'S INSTRUCTIONS, MANUFACTURER'S FIELD REPORTS

- .1 Prior to submission check and certify as correct each submission. Issue to Departmental Representative each submission at least 14 days before reviewed submission will be needed.
- .2 Submit 3 white print copies of each item requested.
- .3 For products bearing the 'Ecologo' of the Environmental Choice Program, Environment Canada, Canadian Environmental Protection Act, Environmental Choice Product Guidelines:
  - .1 Submit two copies of the licensing criteria statements and the verification of compliance with Sections 3(a) and 3(b) of the ECP to the Departmental Representative. For adhesives, paints, primers and sealants, cleaners and degreasers, floor polishes, water borne surface coatings, indicate VOC in g/l.
  - .2 Alternatively, material in original containers bearing the 'Ecologo' or products bearing the 'Ecologo' will satisfy this requirement.
- .4 Responsibility for errors, omissions or deviations from requirements of Contract Documents is not relieved by Departmental Representative's review of submittals.



#### 1.14 SAMPLES

- .1 Submit duplicate samples.
- .2 Identify manufacturer's name, product and colour.
- .3 Installed work shall match reviewed sample.

#### 1.15 ADDITIONAL DRAWINGS

- .1 Departmental Representative may furnish additional drawings to clarify work.
- .2 Such drawings become part of Contract Documents.

#### 1.16 PROTECTION

- .1 Protect existing work from damage.
- .2 Replace damaged existing work with material and finish to match original.
- .3 Provide temporary, non-combustible, steel stud and drywall dustproof partitions between occupied and work areas. Maintain access to fire exits and washroom facilities. Remove partition on completion of work.

#### 1.17 EXISTING SERVICES

- .1 Establish location, protect and maintain existing utility lines.
- .2 Maintain existing services in occupied areas.
- .3 Use designated existing sanitary facilities.
- .4 Use existing water and electrical services at no cost.
- .5 Use elevator designated, protect walls from damage, not required.

#### 1.18 TEMPORARY FACILITIES AND SERVICES

- .1 Provide and maintain temporary facilities and services required to Carry out work.
- .2 Remove temporary facilities and services on completion of work.
- .3 Hoarding: erect temporary site enclosure
- .4 Dust Barriers:
  - .1 Provide dust tight screens or insulated SCREENS partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
  - .2 Maintain and relocate protection until such work is complete.

### 1.19 MATERIAL AND EQUIPMENT

- .1 Use new products unless otherwise specified.
- .2 Deliver and store material and equipment to manufacturer's instructions with manufacturer's labels and seals intact.
- .3 When material or equipment is specified by standard or performance specifications, upon request of Departmental Representative, obtain from manufacturer an independent testing laboratory report, stating that material or equipment meets or exceeds specified requirements.

### 1.20 CONCEALMENT

- .1 Conceal pipes, ducts, conduits and wiring in finished areas as much as possible. Note no new work in/above existing ceiling. All exposed conduit on existing block walls.

### 1.21 CUTTING AND REMEDIAL WORK

- .1 Co-ordinate work to keep cutting and remedial work to a minimum.
- .2 Execute cutting and remedial work required. Notify Departmental Representative before cutting, boring or sleeving structural members.
- .3 Prior to cutting or drilling horizontal or vertical surfaces including concrete, concrete block or other structural substrate, determine location of reinforcing, service lines, pipes, conduits or other items by x-ray, ground penetrating radar or other appropriate method. Submit findings to Departmental Representative prior to cutting or drilling.
- .4 Do not cut, puncture or drill any member of ceiling system which forms part of an integrated assembly with mechanical or electrical components.
- .5 Use specialists in affected material to execute cutting and remedial work.
- .6 Match work to adjoining construction and finishes.
- .7 Fit components tight to adjoining surfaces.
- .8 Make good surfaces exposed or disturbed by work with material and finish to match existing adjoining surfaces.
- .9 After patching wall, ceiling or other painted surfaces, paint the entire wall or area up to the next change in plane or direction as directed by Departmental Representative.

### 1.22 FASTENINGS

- .1 Provide fastenings of type, size and spacing required to assure secure anchorage.
- .2 Obtain Departmental Representative's permission before using explosive actuated fasteners.

### 1.23 CO-ORDINATION AND CO-OPERATION

- .1 Site will be occupied during execution of work.
- .2 Building will be occupied during execution of work.
- .3 Work area will not be occupied during execution of work.
- .4 Execute work with minimum disturbance to occupants, public and normal use of building and work area.
- .5 Maintain access and exits.
- .6 Where security has been reduced by work of contract, provide temporary means to maintain security.

### 1.24 ALTERATIONS TO EXISTING BUILDING

- .1 Remove and recycle or dispose of:
  - .1 Carpet
- .2 Remove in good order, turn over to Department, and store within building where designated by Departmental Representative:
  - .1 Lights

### 1.25 INSPECTION AND TESTING

- .1 When initial tests and inspections reveal work not to contract requirements, pay for tests and inspections required by Departmental Representative on corrected work.

### 1.26 COST BREAKDOWN

- .1 Within 48 hours of notification of acceptance of bid furnish a cost breakdown by Section aggregating contract amount.
- .2 Within 48 hours of acceptance of bid submit a list of subcontractors.

### 1.27 SCHEDULING

- .1 On award of contract submit bar chart construction schedule for work, indicating anticipated progress stages within time of completion. When schedule has been reviewed by the Departmental Representative take necessary measures to complete work within scheduled time. Do not change schedule without notifying Departmental Representative.
- .2 Carry out work Monday to Friday from 6:00am to 12:00pm hours and on Saturdays, Sundays and statutory holidays.
- .3 Carry out noise generating work Monday to Friday from 6:00am to 12:pm hours and on Saturdays, Sundays and statutory holidays. Must provide 2 days notice to occupants prior to work.
- .4 Carry out interior painting in occupied areas Monday to Friday from only and on Saturdays, Sundays, and statutory holidays. Thoroughly ventilate areas painted during "off hours".
- .5 Interior painting of washrooms, service areas, new space or unoccupied space may be carried out during normal working hours.
  - .1 Provide continuous ventilation during and after application of paint. Run ventilation system 24 hours per day during installation at 30% outside air; provide continuous ventilation for 7 days after completion of application of paint.

### 1.28 CLEANING

- .1 Maintain project free of accumulated waste and rubbish.
- .2 Final cleaning:
  - .1 Remove temporary protection.
  - .2 Remove dust, dirt and foreign matter from surfaces. HEPA vacuum interior surfaces.
  - .3 Polish glass and metal surfaces.

### 1.29 CONSTRUCTION & DEMOLITION WASTE

- .1 Carefully deconstruct and source separate materials/equipment and divert from D&C waste destined for landfill to maximum extent possible. Reuse, recycle or sell material off site for reuse except where indicated otherwise. On site sales are not permitted. Target for this project is 50% diversion from landfill.
- .2 For construction and demolition projects, even for those not over 2,000 m<sup>2</sup> total floor area, source separate waste and maintain waste audits in accordance with the Environmental Protection Act, Ontario Regulation 102/94 and Ontario Regulation 103/94.
  - .1 Provide facilities for collection, handling and storage of source separated wastes.
  - .2 Source separate the following waste:
    - .1 Brick and portland cement concrete.
    - .2 Corrugated cardboard.

- .3 Wood, not including painted or treated wood or laminated wood.
- .4 Gypsum board, unpainted.
- .5 Steel.
- .3 Submit a waste reduction workplan indicating the materials and quantities of material that will be recycled and diverted from landfill.
  - .1 Indicate how material being removed from the site will be reused or recycled.
- .4 Submit proof that all waste is being disposed of at a licensed land fill site or waste transfer site. A copy of the disposal/waste transfer site's license and a letter verifying that said landfill site will accept the waste must be supplied to Departmental Representative prior to removal of waste from the demolition site.

### 1.30 ASBESTOS DISCOVERY

- .1 If during alteration work existing asbestos material, other than known asbestos-containing material specified in Section 02 82 00.01 or 02 82 00.02 is discovered do not remove such asbestos-containing material; stop work and immediately notify Departmental Representative.

### 1.31 DESIGNATED SUBSTANCES

- .1 The work area has been surveyed for the presence of designated substances referred to in the Occupational Health and Safety Act and Regulations for Construction Projects, O.Reg. 213/91 as amended.
- .2 There are "designated substances" as defined by the Occupational Health and Safety Act Revised Statutes of Ontario, 1990, Chapter 0.1 as amended in the work area.
- .3 The list of designated substances present at the work area is attached at the end of this section.
- .4 Provide copies of this list to each prospective subcontractor prior to entering into a contract with them.
- .5 Post prominent notices identifying and warning of the hazardous agent in the part of the workplace in which the agent is found or used. Notices shall be in English and other languages prescribed under the Act.
- .6 Material May be Present at:
  - Asbestos- Used up till '83 in ac. and hard plaster.
  - Lead- Sound baffles, paint, metal trim paint, structural paint, Storage tanks, bell and bowl fittings plumbing, flashing.
  - Silica- Cement, Concrete dust, refractory brick and insulations.
  - Mercury- in switches, flourescent light tubes thermostats.
  - Benzene- in paints and adhesives.
  - PCBs- in ballasts.

Mould- on painted insulation of air handling units, duct lining, gypsum board, acoustic tile ceiling, concrete block.  
Arsenic and acrylonitrile in paints and adhesives  
Vinyl chloride in pipes, conduits and interior finishes.  
CFC- in air conditioning unit

### 1.32 HALOCARBONS

- .1 Comply with Federal Halocarbon Regulations 2003 under the Canadian Environmental Protection Act 1999, EPAM and PWGSC Ontario Region Halocarbon Information Sheet dated March 2010.

### 1.33 SPECIAL PROTECTION AND PRECAUTIONS

- .1 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and the provision of material safety data sheets acceptable to ESDC - Labour Program.

### 1.34 IAQ - INDOOR AIR QUALITY

- .1 Comply with CSA Z204-94(R1999), Guideline for Managing Indoor Air Quality in Office Buildings and CSA B651-12, Annex A, article A.5 Indoor Air Quality.

### 1.35 POLLUTION CONTROL

- .1 Spills of deleterious substances:
- .2 Immediately contain, limit spread and clean up in accordance with provincial regulatory requirements.
- .3 Report immediately to Ontario Spills Action Centre: 1-800-268-6060.
- .4 Further information on dangerous goods emergency cleanup and precautions including a list of companies performing this work can be obtained from the Transport Canada 24-hour number (613) 996-6666 collect.

### 1.36 OPSS AND OPSD

- .1 OPSS Ontario Provincial Standard Specifications and OPSD Ontario Provincial Standard Drawings quoted in these specifications are available online at <http://www.raqsa.mto.gov.on.ca/techpubs/ops.nsf/OPSHomepage>.

### 1.37 Security

- .1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.
- .2 Security clearances: Full time Site Supervisor employed on this project will be subject to security check. Obtain clearance as instructed.

.3 Site Supervisor is required to be on site when any subtrades are present and on site.

### 1.38 METRIC SIZED MATERIALS

.1 SI metric units of measurement are used MATERIAL exclusively on the drawings and in the specifications for this project.

.2 The Contractor is required to provide metric products in the sizes called for in the Contract Documents except where a valid claim can be made that a particular product is not available on the Canadian market.

.3 Claims for exemptions from use of metric sized products shall be in writing and fully substantiated with supportive documentation. Promptly submit application to Departmental Representative for consideration and ruling. Non-metric sized products may not be used unless Contractor's application has been approved in writing by the Departmental Representative.

.4 Difficulties caused by the Contractor's lack of planning and effort to obtain modular metric sized products which are available on the Canadian market will not be considered sufficient reasons for claiming that they cannot be provided.

.5 Claims for additional costs due to provision of specified modular metric sized products will not be considered.

## PART 2 - PRODUCTS

### 2.1 NOT USED

.1 Not used.

## PART 3 - EXECUTION

### 3.1 NOT USED

.1 Not used.

## PART 2 - ARCHITECTURAL REQUIREMENTS

### 1.0 SECTION INCLUDES

- .1 Demolition
- .2 Architectural Woodwork
- .3 Doors and Frames
- .4 Door Hardware
- .5 Hardware Schedule
- .6 Partitions
- .7 Flooring
- .8 Base
- .9 Interior Painting
- .10 Paint Application
- .11 Manufactured Specialties
- .12 Security Glazing Film

### 1.1 DEMOLITION

- .1 Perform deconstruction and demolition in accordance with:
  - .1 Canadian Standards Association (CSA International), CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

### 1.2 ARCHITECTURAL WOODWORK

- .1 Materials:
  - .1 Exposed hardwood: not required.
  - .2 Exposed plywood: hardwood plywood to ANSI/HPVA HP-1-[2009], Standard for Hardwood and Decorative Plywood, veneer core construction, type II bond, G2S grade, rotary cut, birch, urea formaldehyde free.
  - .3 Concealed plywood: Douglas fir to CSA O121-08, G1S, standard construction, urea formaldehyde free.
  - .4 Laminated plastic: not required.
  - .5 Melamine: not required.
  - .6 Particleboard core: not required
  - .7 MDF core: not required.
  - .8 Hardboard: to CAN/CGSB-11.3-M87, type 2.
  - .9 Cabinet hardware: not required

### 1.3 DOORS AND FRAMES

- .1 Wood doors, frames: wood products CAN/CSA-Z809-08(R2013), SFI or Forestry Stewardship Council (FSC) certified.
  - .1 Door material: to CAN/CSA-0132.2-Series 90(R2003), flush; interior Type II bond adhesive; plywood faced birch wood veneer, Grade 1 Premium. Solid core with particleboard 35 mm wood stiles and 75 mm rails.
  - .2 Frame material: to AWI/AWMAC/WI Architectural Woodwork Standards (AWS) Edition 1-2009, interior; birch; custom grade.
  - .3 Door type: flush.
  - .4 Glass moulding: not required.
  - .5 Door and frame height: 7'-0" high.



- .6 Frame depth: to suit partition type.
- .7 Bumpers: 3 per jamb for single door. 2 per head for double door.
- .8 Finish: paint.
- .9 Fire resistance rating: not required.
- .2 Steel hollow metal doors, frames. Fabrication: to Canadian Steel Door Manufacturers Association, "Specifications for Commercial Steel Doors and Frames" 2009; extruded rigid PVC thermal break; formed steel glass moulding; 45 mm thick door; paint finish, 50 mm frame face. Single door: frame rebate width 900 mm, Frame rebate height 2150 mm unless specified otherwise.
  - .1 Metal: 1.6 mm, sheet steel to ASTM A653/A653M-13 with ZF075 Zinc coating.
  - .2 Core: loose fibreglass for interior doors. Polyurethane for exterior doors. Steel stiffened construction.
  - .3 Door type: flush.
  - .4 Door and frame height: 7'0" high.
  - .5 Frame depth: to suit partition type.
  - .6 Bumpers: 3 per jamb for single door. 2 per head for double door.
  - .7 Tolerance: plumb, square, level, warp and twist free.
  - .8 Fire resistance rating: not required.

#### 1.4 DOOR HARDWARE

- .1 Keying: each lock different key under [existing] Grand Master Key System. Two keys per lock. Two master keys.
- .2 Use ULC listed and labelled hardware for doors in fire rated partitions and fire exits.
- .3 Use lock and latch sets with U shape lever handles meeting requirements of CSA B651-12, Accessible Design for the Built Environment unless specified otherwise.
- .4 Hinge: to ANSI/BHMA-A156.1-2013, type indicated, 626 dull chrome.
- .5 Door closer: to ANSI/BHMA-A156.4-2013, surface closer, modern type with cover, sprayed enamel finish, metallic 689 aluminum, size to suit door width and mass, back check, to operate at a minimum pressure not exceeding 38 N for exterior doors, 22 N for interior doors and close in not less than 5 seconds from an open position of 90°, minimum piston size - 38 mm, minimum shaft size 12 mm, all weather fluid good for -35°C to 49°C, forged steel parallel arm.
- .6 Lock and latch set (bored): to ANSI/BHMA- A156.2-2011, Series 4000, function indicated, 626 dull chrome.
- .7 Lock and latch set (mortised): to ANSI/BHMA- A156.13-2012, Operational Grade 1, Security Grade 1, lock trim on interior, function indicated.
- .8 Electric strike: to be ULC listed and fail safe.
- .9 Floor door stop: to ANSI/BHMA-A156.16-2013, dome type, cushion secured by concealed fasteners, anti-rotation stud, type L22141 finish 626 for doors without threshold and type L22161, finish 626 for doors with threshold.
- .10 Lock protector: to be stainless steel.

### 1.5 HARDWARE SCHEDULE

- .1 Indicated hardware quantities are for one door or one pair of doors only; provide this quantity for each door or pair of doors listed.
- .2 Provide hardware, accessories and mounting hardware required to achieve function indicated.
- .3 Equip interior door 01-00 with:
  - .1 3 pr. hinges, NRP.
  - .2 1 door closer.
  - .3 1 lock and latch set (mortised), Storeroom Lock.
  - .4 1 electric strike.
- .4 Equip change room door 01-01 with:
  - .1 2 pr. hinges
  - .2 1 lock and latch set (mortised), Classroom Lock.
  - .3 1 door floor stop
- .5 Equip copy room door 01-02 with:
  - .1 2 pr. hinges
  - .2 1 lock and latch set (mortised), Classroom Lock.
  - .3 1 door floor stop
- .6 Equipment IT room pair of doors 01-03A and 01-03B with:
  - .1 2 pr. Hinges each.
  - .2 1 lock and latch set (bored),storeroom lock
  - .3 1 dummy trim
  - .4 1 floor stop.
  - .5 1 flush bolts
- .7 Equip Evidence room door 01-04 with: Existing door
  - .1 3 pr. hinges, (Existing)
  - .2 1 door closer. (New)
  - .3 1 lock and latch set (mortised), Storeroom Lock.(New)
  - .4 1 electric strike. (New)

### 1.6 PARTITIONS

- .1 Gypsum board: plain and Type X to ASTM C1396/C1396M-13, 12.7 and 15.9 mm thick, 1 layer each side and 2 layer/1 layer. Refer to wall sections.
  - .1 Studs: steel, 92 mm wide. Stud spacing: 400 mm o.c.and 25 guage as indicated
  - .2 Partition height: floor to ceiling and to 9'-0" as indicated.
  - .3 Insulation: 40 kg/m<sup>3</sup> mineral fiber batt, Ecologo certified.
  - .4 Acoustic sealant: one part silicone to ASTM C919-12 and ASTM C920-14, primerless, Type S, Grade NS, Class 25, SWRI validated, Ecologo certified, maximum VOC 60 g/L.
  - .5 Acoustic gasket: continuous, 18 x 3 mm thick vinyl foam tape, 15 durometer hardness, white, adhesive coated one side.
  - .6 Tolerance: 1:600.
  - .7 Application: joints taped and filled, [paint] finish.

- .2 Framing:
  - .1 Metal channel stiffener: 38 x 38 mm size, 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.
  - .2 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
  - .3 Cross brace steel studs adjacent corridor doors with channel stiffeners extending minimum 600 mm to resist frame spreading.
- .3 Security mesh:
  - .1 Materials: 3.25 mm galvanized, expanded steel diamond mesh, diamond size 25 x 50 mm, 63% open; 1.897 mm thick x 100 mm wide galvanized steel strap. To be Duramex 3.4-97, Amico ASM .75-95 or approved equal
  - .2 Install security mesh continuously over face of studs with non-removable screws 600 mm oc vertically at each stud and 300 mm oc horizontally at top and bottom tracks. Lap joints minimum 100 mm.
  - .3 Install continuous steel strapping horizontally over mesh at 600 mm cc vertically. Fasten with self tapping galvanized screws and washers at each stud.

## 1.7 FLOORING

- .1 Linoleum: to ASTM E648/NFPA 253 Class 1.
  - .1 Tested in accordance with CAN/ULC-S102- 10: flame spread 150, smoke developed 145.
  - .2 Wear resistance: loss of thickness less than 0.005 mm after 100 cycles with Taber Abraser using H22 wheels and a load of 1 kg.
  - .3 Fading: when tested to DIN 53389 minimum lightfastness of 6 on the Blue Scale.
  - .4 Rolling load: no damage loading 3 wheels with 30 kg per wheel at 25,000 cycles.
  - .5 Impact sound reduction: when tested in accordance with ISO 717-2:1996/Amd 1:2006: improvement between 6-12 dB, depending on thickness.
  - .6 To be installed with Flash Coving at base.

## 1.8 BASES

- .1 Prefabricated Cove Bases:
  - .1 Materials
    - .1: Fabricated from same material and dye lots as linoleum flooring, in maximum practical lengths, with 38 mm x 38 mm (1 1/2" x 1-1/2") formed aluminum reinforcing bonded to back of base material.
    - .2 Metal Base Cap: For adhesive installation; stainless steel cap;
    - .3 Prefabricated Cove Base Adhesive: Low-VOC premium cove base adhesive recommended by both flooring and prefabricated cove base manufacturer

- .4 Concrete Moisture Emission Reducer: Provide 1 of following:
  - .1 "Poxycrete" by Duochem Inc.
  - .2 "Flextech 4010 Moisture Barrier" by Flextile Ltd.
  - .3 "Koester VAP I® 2000" by Koester American Corporation.
  - .4 "Sikafloor® 81 EpoCemCA" by Sika Canada Inc.
- .2 prefabricated cove base fabricated from linoleum sheet flooring Product used for field and stainless steel cap.
- .3 Related Sections: Following description of work is included for reference only and shall not be presumed complete:
- .4 Supply of linoleum sheet flooring material for manufacturing prefabricated cove base: Section 1.6, Linoleum.
- 5. Riser height to be [100]mm or 4" high.
- .2 Prefabricated Cove Base Application:
  - .1 Provide prefabricated cove base for integral base indicated in Finish Schedule.
  - .2 Dry-fit prefabricated cove base; cut and fit material to required lengths. Mitrecut inside and outside corners.
  - .3 Dry-fit and cut metal cove cap prior to prefabricated cove base installation.
  - .4 Scribe glue line on walls and floor at edge of prefabricated cove base material.
  - .5 Apply adhesive in full spread (100% coverage on 2 surfaces) for full length of prefabricated cove base material. Apply prefabricated cove base to wall surface straight and level.
  - .6 Slide metal base cap behind prefabricated cove base material.
  - .7 Hand roll prefabricated flash cove base material onto wall and floor surface removing bumps, ripples and fishmouths. Remove excess adhesive.
  - .8 Heat weld seams vertical and horizontal in prefabricated cove base material.
- .2 Resilient Base:
  - .1 Material: to ASTM F1861-08(2012)e1, type I rubber.
  - .2 Height: [100] mm.
  - .3 Profile: coved at resilient flooring.
  - .4 Corners: preformed.

## 1.9 INTERIOR PAINTING

- .1 Conform to latest Master Painters Institute (MPI) requirements for interior painting work including preparation and priming.
- .2 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.
- .3 Provide paint products meeting MPI "Environmentally Friendly" E3 ratings based on VOC (EPA Method 24) content levels.
- .4 Where indoor air quality (odour) is a problem, use only MPI listed materials having a minimum E3 rating.
- .5 Plaster and Gypsum Board: gypsum wallboard, drywall, "sheet rock type

material", etc., and textured finishes

- .1 INT 9.2A Latex eggshell or satin finish over latex sealer.
- .2 INT 9.2B High performance architectural latex semi-gloss finish.
- .6 Dressed Lumber: including doors, door and window frames, casings, mouldings, etc.
  - .1 INT 6.3A High performance architectural latex semi-gloss finish.
- .7 Provide paint products bearing the 'Ecologo' of the Environmental Choice Program, Department of the Environment, Canadian Environmental Protection Act, CCD-47-2005: Architectural Surface Coatings and CCD-48-2006: Surface Coatings - Recycled Water-Borne.
- .8 Except for 0 VOC products, only paints bearing Ecologo are acceptable for use on this project.

#### 1.10 PAINT APPLICATION

- .1 Carry out interior painting in occupied areas Monday to Friday from 18:00 to 07:00 hours only or on Saturdays, Sundays and statutory holidays. Use low odour paints and additives and thoroughly ventilate painted areas. Interior painting of washrooms, service area, new space or unoccupied space, may be carried out during normal working hours. Place signs indicating "Fresh Paint".
- .2 Apply one additional finish coat to surfaces with deep, dark or accent colours called for on schedule.

#### 1.11 MANUFACTURED SPECIALTIES

- .1 Materials:
  - .1 Stainless steel: to ASTM A167-99(2009), type 302.
  - .2 Steel: to CSA G40.20-13/G40.21-13, Grade 300W.
  - .3 Sheet steel: to ASTM A1008/A1008M-13, cold rolled sheet, not oiled.
  - .4 Galvanized sheet steel: to ASTM A653/A653M-13, commercial grade, stretcher levelled, Z275 zinc coating designation to ASTM A653/A653M-13, unpassivated.
  - .5 Baked enamel: 1 coat metal conditioner to CGSB 31-GP-107Ma-90; 1 coat primer to CAN/CGSB-1.81-M90, Type 2; 2 coats enamel to CAN/CGSB-1.88-92, Type 2 Baking, bake to smooth, hard finish.
  - .6 Chrome plating: to ASTM B456-11e1, polished finish.
  - .7 Galvanizing: hot dip to ASTM A123/A123M-13, minimum 600 g/m<sup>2</sup>, Coating Grade 85.
  - .8 Rubber: moulded, 30 to 40 durometer hardness.

#### 1.12 SECURITY GLAZING FILM

- .1 For the purposes of this specification applying definitions follow:
  - .1 Safety: Reduction of risk of injury, loss or death due to accidental, natural or unintentional causes.
  - .2 Security: Reduction of risk of injury, loss or death due to intentional actions of others.
- .2 Submit one representative sample each pattern and type of glazing film

in accordance with Section 01 33 00. Submit one 100 x 100 mm sample of film installed on 7 mm thick clear plate glass. Submit 300 mm long sample of glazing film frame.

- .3 Qualifications of glazing film and frame applicator: trained, approved and certified by glazing film manufacturer.
- .4 Ensure warranty includes items as follows:
  - .1 Maintain adhesion properties without blistering, bubbling or delaminating from glass.
  - .2 Maintain appearance without discolouration.
  - .3 Remove, replace and reapply defective materials.
  - .4 In event of product failure under warranty terms, remove and re-apply film without glass replacement at no cost to Departmental Representative.
- .5 Security Film - General: Multi-ply optically clear polyester film with factory applied adhesive between each layer, abrasion resistant coating and release liner.
  - .1 Number of laminations: 3.
  - .2 Total thickness of installed film: 0.31 mm.
  - .3 Elongation: to ASTM D882.
  - .4 Break strength: to ASTM D882.
  - .5 Young's Modulus: to ASTM D882.
  - .6 Tear resistance: to ASTM D1004-08.
  - .7 Abrasion resistance: ASTM D1044.
  - .8 Flammability: surface burn characteristics to ASTM E84.
  - .9 Adhesive: high mass pressure sensitive, acrylic base.
- .6 Mechanical anchoring: 2 sided system, aluminum alloy 6063T5 or 6060T5, with elastomeric silicone rubber gaskets to ASTM C1115. Finish to match adjacent window frame.
- .7 Installation to be as follow:
  - .1 Cut film edges straight and square.
  - .2 Apply and attach film to glass in accordance with manufacturer's written instructions.
  - .3 Mechanically anchor film to window frame, where specified, in accordance with manufacturers written instructions.
  - .4 Splicing:
    - .1 Splice film only when glass is greater in width than film.
    - .2 Splice film only after receipt of written approval from Departmental Representative.
    - .3 Use butt factory edges only.
  - .5 Use clean, clear water to remove protective water soluble coating on adhesive side of film.
  - .6 Use only water and film slip solution on glass to facilitate positioning of film.
  - .7 Ensure removal of excess water from between film and glass.
  - .8 Remove left over material from work area and return work area to original condition.

<u>Section</u>	<u>Title</u>	<u>Pages</u>
02 81 00	ASBESTOS SCOPE OF WORK	3
02 81 00.01	ASBESTOS MINIMUM PRECAUTIONS	6
02 81 00.02	ASBESTOS INTERMEDIATE PRECAUTIONS	8
02 83 10	LEAD PAINT ABATEMENT MINIMUM PRECAUTIONS	7
02 83 11	LEAD PAINT ABATEMENT INTERMEDIATE PRECAUTIONS	10
APPENDIX A	ASBESTOS PRODUCT RE-ASSESSMENT REPORT	5
	(NOTE: FULL REPORT AVAILABLE UPON REQUEST)	
	DESIGNATE SUBSTANCES ASSESSMENT	39
	LEAD PAINT SAMPLING	4

## 1 GENERAL

### 1.1 GENERAL REQUIREMENTS

1.1.1 Read this section in conjunction with all other sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.

### 1.2 Related Work Specified Elsewhere

.1	Asbestos Abatement – Minimum Precautions	Section 02 82 00.01
.2	Asbestos Abatement – Intermediate Precautions	Section 02 82 00.02
.3	Lead Abatement – Minimum Precautions	Section 02 83 10
.4	Lead Abatement – Intermediate Precautions	Section 02 83 11

1.2.1 The *Asbestos Product Survey(s)* identifies the location and condition of all known asbestos-containing materials (ACM) to be disturbed by the work of this contract. This document fulfils the requirements of the report required by Ontario Regulation 278/05.

### 1.3 Site Conditions

1.3.1 For details on the site conditions with respect to asbestos refer to the “*Asbestos Product Survey*”, prepared by OH Solutions Inc.

1.3.2 For details on the site conditions with respect to designated substances refer to the “*Designated Substance Survey*”, prepared by OH Solutions Inc.

1.3.3 Asbestos abatement contractor is responsible for verifying all quantities.

1.3.4 Asbestos abatement will be phased. The contractor shall assume that multiple Site visits are required in order to complete the Scope of Work. It is expected that multiple Type 2 (Intermediate) work areas will be constructed during this project.

### 1.4 Outline of Work (refer to Work Area Architectural, Mechanical and Electrical Drawings for extent of work area)

1.4.1 Perform the following utilizing Type 2 (Intermediate) abatement procedures (02 82 00.02).

1.4.1.1 Work with general contractor to install all walls that may potentially disturb the existing asbestos-containing texture coat.

1.4.1.2 Remove and dispose of texture coat in all locations where access to structure is required.

1.4.1.3 Install all equipment, lighting, hangers, conduit, signs, scheduled to be fastened to existing texture coat.

1.4.1.4 Remove all walls, equipment, lighting, hangers, conduit, signs, scheduled for demolition or relocation and is currently fastened to or abuts the existing texture coat. Repair existing texture coat following removal or relocation.



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- 1.4.2 Perform the following utilizing Type 1 (Minimum) abatement procedures (02 82 00.01).
- 1.4.2.1 Work with general contractor to install all walls that may potentially disturb the existing asbestos-containing drywall.
- 1.4.2.2 Work with electrical contractor to install new electrical box that may potentially disturb the existing asbestos-containing drywall.
- 1.4.3 Perform the following utilizing Type 1 (Minimum) lead abatement procedures (02 83 10).
- 1.4.3.1 All drilling, fastening, etc to the existing plaster walls shall be conducted using a power tool with an effective dust collection system equipped with a HEPA filter or with non-powered hand tool (other than manual scraping and sanding).
- 1.4.4 Perform the following utilizing Type 2 (Intermediate) lead abatement procedures (02 83 11).
- 1.4.4.1 The removal of loose paint using scraping or sanding methods with non-powered hand tools.
- 1.4.4.2 Manual demolition of lead-painted plaster and drywall by striking with a sledgehammer or similar tool.
- 1.5 Schedule
- 1.5.1 Asbestos contractor to determine schedule with general contractor. Assume work to be phased and complete during a combination of regular and non-regular business hours.

END OF SECTION

**1 General**

**1.1 General Requirements**

- .1 Read this section in conjunction with all other sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.

**1.2 Related Work Specified Elsewhere**

- |    |                                    |                     |
|----|------------------------------------|---------------------|
| .1 | Asbestos Abatement – Scope of Work | Section 02 82 00.00 |
| .2 | Asbestos Abatement – Type 2        | Section 02 82 00.02 |

**1.3 Site Conditions**

- .1 A Designated Substances and Asbestos Building Product Survey has been conducted for this facility. The survey is available for review on-site and within the tender documents. Refer to Section 02 82 00.00 for materials containing asbestos to be disturbed during this project.

**1.4 Description of Work**

- .1 Refer to Section 02 82 00.00 for description of work.
- .2 Seal all surfaces from which asbestos has been removed and surfaces potentially contaminated with asbestos, with sealer.
- .3 All work may be subject to inspection and air monitoring inside and outside asbestos work area by the Owner's Consultant. Any contamination of surrounding areas, indicated by visual inspection or air monitoring, shall necessitate complete cleanup of affected areas at no additional cost to the Owner.
- .4 Perform asbestos removal by Type 1 method.
- .5 Contractor to ensure work area is secure.

**1.5 Definitions**

- .1 **HEPA Filter:** High Efficiency Particulate Aerosol filter at least 99.97 percent efficient in collecting 0.3 micrometer aerosol.
- .2 **Polyethylene Sheeting:** Polyethylene sheeting 0.15 mm (6 mil) minimum thickness; with tape seals along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane protection.
- .3 **Authorized Visitor(s):** Owner's Consultant or person(s) representing regulatory agencies, and person(s) authorized by them.
- .4 **Asbestos Work Area(s):** Area(s) where work takes place which will, or may disturb asbestos-containing material, including overspray and fallen material, or settled dust that may contain asbestos.

**1.6 Regulations**

- .1 Comply with Federal, Provincial, and local requirements pertaining to asbestos, provided that in any case of conflict among these requirements or with these specifications the more stringent requirement shall apply.
- .2 Comply with Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations made under The Occupational Health and Safety Act, Ontario Regulation 278/05.
-

- .3 Handle and dispose of contaminated waste as required under Ontario Regulation 558/00 made under The Environmental Protection Act.
- .4 Notify sanitary landfill site in accordance with requirements of Ontario Regulation 558/00.
- .5 Contractor shall ensure that:
  - .1 Measures and procedures prescribed under the Occupational Health & Safety Act and regulations are carried out.
  - .2 Every employee and every worker on project complies with applicable act and regulations.
  - .3 Health & safety of workers and public are protected.
  - .4 All material handling and associated equipment conform to and be operated in accordance with "Workplace Hazardous Materials Information System" (WHMIS).
  - .5 Policies and procedures of the facility are complied with.
  - .6 Contractor may be requested to provide information on their health & safety record.

**1.7 Quality Assurance**

- .1 Ensure work proceeds to Schedule and meets all requirements of this Section. Perform work so airborne asbestos, asbestos waste or water run off does not contaminate areas outside asbestos work area.
- .2 Pay cost to Owner of inspection and air monitoring performed as result of failure to perform work satisfactorily.
- .3 Use only skilled and qualified workers for all trades required for this work.

**1.8 Submittals**

- .1 Before commencing work
  - .1 Obtain and submit all necessary permits for transporting and disposal of asbestos waste.
  - .2 Submit names of supervisory personnel who will be responsible for asbestos area(s). One of these supervisors must remain on Site at all times asbestos removal or clean-up is occurring. Submit proof that all personnel on-site have attended a training course and are certified asbestos trade workers through the Ministry of Training, Colleges and Universities. Submit proof that all supervisors have completed a supervisory course and are certified asbestos abatement supervisors through the Ministry of Training, Colleges and Universities and have performed supervisory function on at least 2 other asbestos removal projects. Submit proposed schedule showing phasing and proposed workforce related to each
  - .3 work area.
  - .4 Laws of province of Ontario shall govern this work. Contractor shall observe all such laws and shall obtain and/or pay all permits, notices, fees, taxes, duties as may be required. Likewise, it is responsibility of contractor to comply with Workers Compensation and Occupational Health and Safety Act.
  - .5 Before commencing any work, Contractor shall submit, in writing, confirmation of good standing with Workplace Safety and Insurance Board (WSIB).

**1.9 Worker and Visitor Protection**

- .1 **Instructions:** Before entering asbestos work area(s), instruct workers and visitors in use of respirators, entry and exit from asbestos work areas and all aspects of work procedures and protective measures. Instruction shall be provided by competent person as defined by Occupational Health and Safety Act.
-

- .2 **Half Face Respirators:** Provide appropriate respiratory equipment for all persons entering asbestos work area including authorized visitors. During wet removal and clean-up in enclosed asbestos work area workers, supervisors, and authorized visitors shall wear positive pressure half-face respirators with minimum N100 filter cartridges in accordance with NIOSH Part 84 requirements (Formerly high efficiency particulate aerosol (HEPA) cartridge filters). Filters once used shall be replaced daily or tested according to manufacturer's specifications and replaced as necessary. Respirators shall be acceptable to Occupational Health Branch of Ministry of Labour. Provide instruction to workers and visitors in use of respirators including qualitative fit testing. No supervisor, worker or authorized visitor shall wear facial hair which may affect the seal between the respirator and face. Maintain respiratory protection equipment in proper functioning and clean condition.
- .3 **Protective Clothing:** Provide workers and visitors that will enter work area with full body coveralls with integral hoods. Once coveralls are worn in asbestos work area, treat and dispose of as asbestos contaminated waste. Workers and visitors shall also wear other protective apparel required by Ministry of Labour construction regulations.
- .4 Before entering asbestos work area(s) put on respirator with new or tested filters, clean coveralls and head covers before entering equipment and access areas or asbestos work area.
- .5 Persons leaving asbestos work area(s) shall remove gross contamination from clothing before leaving asbestos work area. Place contaminated work suit in receptacles for disposal with other asbestos contaminated materials. Clean respirator to ensure that visible contamination is removed. Wet clean inside of respirator. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or clean before removing from equipment and access area, or carry in sealed plastic bag to next site.
- .6 Do not eat, drink, smoke or chew gum or tobacco in asbestos work areas. Smoking is not permitted at this facility.
- .7 Workers and visitors shall be fully protected as specified herein whenever possibility of disturbance of asbestos exists.

## 2 **Products**

### 2.1 **Materials**

- .1 **Polyethylene Sheeting:** 0.15 mm (6 mil) minimum thickness unless otherwise specified; in sheet size to minimize joints.
  - .2 **Rip-Proof Polyethylene:** 0.20 mm (8 mil) fabric made up from 0.13 mm (5 mil) weave and 2 layers 0.04 mm (1.5 mil) poly laminate, in sheet size to minimize joints.
  - .3 **Tape:** Tape suitable for sealing polyethylene to surface encountered under both wet conditions using amended water, and dry conditions.
-

- .4 **Wetting Agent:** Non-foaming surface active agent; mixed with water in concentration to provide thorough wetting of asbestos fibre: Standard of Acceptance, Asbesto-Wet, distributed by Asbetec Distributors, or equivalent.
- .5 **Amended Water:** Water with wetting agent added.
- .6 **Asbestos Waste Receptors:** 2 separate containers of which 1 shall consist of 0.15 mm (6 mil) minimum thickness polyethylene bag. Other container may be 0.15 mm (6 mil) minimum thickness polyethylene bag. Other container shall be adequate to prevent perforating rips, or tears in first container during filling, transport or disposal. Containers must be acceptable to disposal Site selected and Ministry of Environment.
- .7 **Sealer:** Sealer for purpose of trapping residual fibre debris. Product must have flame spread and smoke development ratings both less than 25. Product shall leave no stain when dry: TC-55 (clear), A/D Fire Protection Systems Inc., Scarborough, Ontario or equivalent. For mechanical equipment, pipes, boilers, etc. use high temperature sealer only: Chil-Abate CP210 or equivalent, Childers Products Company, Mississauga, Ontario.
- .8 **Sprayer:** Garden-type portable manual sprayer, low velocity, capable of producing mist or fine spray.
- .9 **Ground Fault Panel:** Portable electrical panel equipped with ground fault circuit interrupters (5 mA protection) of sufficient capacity to power all electrical equipment and lights in asbestos work area. Panel complete with ground fault interrupter lights, test switch to ensure unit is working, and reset switch. Installed by licensed technician.
- .10 **HEPA Vacuum:** Vacuum with all necessary fittings, tools and attachments. Air must pass HEPA filter before discharge.
- .11 **Protective Coveralls:** Disposable full body coveralls complete with elasticized hoods made of spun polyolefin material Tyvek by Dupont or nonwoven material Kleenguard by Kimberley Clark.
- .12 **Flexible ducting:** Metal reinforced flexible ductwork, 12" diameter minimum.
- .13 **Power Sprayer:** Standard of acceptance - Graco Maxi-wetter, or equivalent.
- .14 **Encapsulant:** Standard of acceptance - Ocean No. 666, Ocean Fire Retardants Inc., or equivalent, coloured bright red.

### 3 Execution

#### 3.1 Asbestos Work Areas

- .1 Move equipment, tools, furnishings, and stored materials which can be moved without disturbing asbestos-containing materials.
- .2 Maintain emergency and fire exits from asbestos work area, or establish alternative exits satisfactory to authorities having jurisdiction.
- .3 Provide temporary lighting in asbestos work area to levels that will permit work to be done safely and well.
- .4 Provide fire extinguisher at each emergency exit, and in decontamination facilities. Protect extinguishers with polyethylene sheeting in manner that will not hamper emergency use.
- .5 Provide soap, water and towels for washing of worker's face and hands when exiting

work areas.

### 3.2 Maintenance of Work Area

- .1 Maintain work area in tidy condition.
- .2 Ensure barriers remain intact and work area is clearly defined repair damaged barriers and remedy defects immediately upon discovery.
- .3 Visually inspect work area at beginning and end of each working period.

### 3.3 Do Not Commence Asbestos Removal Work Until

- .1 Arrangements have been made for disposal of waste.
- .2 Tools, equipment and waste materials receptors are on hand.
- .3 Signs are displayed in areas where access to work area is possible. Signs shall read:

#### CAUTION

Asbestos Hazard Area  
No Unauthorized Entry  
Wear assigned protective equipment  
Breathing asbestos dust may cause serious bodily harm.

- .4 Proof of notification to Ministry of Labour has been submitted. The Owner's Consultant has been notified of intention to proceed and has reviewed enclosures, equipment and procedures.

### 3.4 Removal

- .1 Before removing asbestos, prepare Site as described in articles 3.1 and 3.2.
- .2 Wet removal of asbestos containing materials will occur when hand tools are used to cut, shape or drill manufacture products containing asbestos. Saturate asbestos to prevent release of airborne fibres during removal.
- .3 Treat materials removed as asbestos contaminated waste and dispose of as such. If materials or equipment removed to access asbestos are to be re-used (cladding, etc.), wet clean or vacuum as appropriate prior to being salvaged
- .4 After completion of removal of asbestos, clean surfaces from which asbestos has been removed with stiff bristle brushes, vacuum, or wet-sponge if appropriate to remove all visible material.
- .5 Carefully place asbestos waste in inner bag of asbestos waste receptor. Clean inner bag of gross contamination and place in clean 6 mil outer bag. If waste is likely to tear inner bag, then instead of outer bag use fibre or metal drum, cardboard or wood box, or other suitably sturdy container.
- .6 If double plastic bags are used, inner bag shall be cleaned of gross contamination and placed in a clean 6 mil outer plastic bag in container cleaning room immediately prior to transfer from Site.
- .7 Treat all materials removed to expose asbestos, as asbestos-contaminated waste unless such materials are specified to be salvaged.
- .8 After vacuuming to remove visible asbestos, wet clean entire work area, including equipment. Request visual inspection and acceptance. Following inspection and acceptance,
- .9 Place asbestos waste into asbestos waste receptors. Double polyethylene bags are to be used; inner bag shall be cleaned of gross contamination and placed in a clean **6 mil** outer polyethylene bag in container cleaning room immediately prior to transfer from Site.

### **3.5 Air Monitoring**

- .1 The, Owner's Consultant may arrange for air samples to be taken from commencement of work until completion of cleaning operations, outside of asbestos work area(s) in accordance with NIOSH methods.
- .2 If air monitoring or visual inspection indicates that areas outside current asbestos work areas are contaminated above 0.01 fibre/mL clean these areas in same manner as that applicable to asbestos work areas, at no cost to Owner.
- .3 Clearance level is  $\leq 0.01$  f/mL.

### **3.6 Inspection**

- .1 From commencement of work until completion of clean-up operations, the Owner's Consultant will be present on a periodic basis; both inside and outside asbestos work area(s).
- .2 If asbestos work area(s) or adjacent areas are found unacceptable in accordance with standards specified or required by authorities having jurisdiction, correct such deficiencies at no cost to the Owner.
- .3 Pay cost to provide re-inspection of work found not to be in accordance with these specifications and requirements of authorities having jurisdiction.

### **3.7 Waste Transport and Disposal**

- .1 Conform to requirements of Regulation 588/00 under Environmental Protection Act for Waste Management, transporting and disposal of hazardous waste.
- .2 Check with landfill operator to determine type of waste containers acceptable.
- .3 Ensure shipment of containers to landfill is taken by waste hauler licensed to transport asbestos waste. Waste hauler in possession of valid Ministry of Environment Certificate of Approval to transport asbestos waste.
- .4 Each load requires completion of bill of lading showing type and weight of hazardous waste being transported. Provide copies of bill of lading indicating acceptance of waste at landfill.
- .5 Co-operate with Ministry of Environment inspectors and immediately carry out instructions for remedial work at landfill to maintain environment, at no additional cost to the Owner.
- .6 Ensure landfill operator is fully aware of hazardous material being dumped.
- .7 Ensure that containers used for dumping are locked and covered at all times.

END OF SECTION

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## **1. GENERAL**

### **1.1 General Requirements**

- .1 Read this section in conjunction with all other sections so as to comply with the requirements of Division 1 and the General Conditions of the Contract.

### **1.2 Related Work Specified Elsewhere**

- .1 Asbestos Abatement - Scope of Work                      Section 02 82 00.00
- .2 Asbestos Abatement – Type 1                                Section 02 82 00.01

### **1.3 Site Conditions**

- .1 For details on the site conditions with respect to asbestos and other Designated Substances please refer to the assessments included within the Tender Documents.

### **1.4 Description of Work**

- .1 Refer to Section 02 82 00.00 for description of work.
- .2 Seal all surfaces from which asbestos has been removed and surfaces potentially contaminated with asbestos, with sealer.
- .3 All work may be subject to inspection and air monitoring inside and outside asbestos work area by the Owner's Consultant. Any contamination of surrounding areas, indicated by visual inspection or air monitoring, shall necessitate complete cleanup of affected areas at no additional cost to the Owner.
- .4 Prepare site in accordance with O.Reg. 278/05 and the requirements of this section.
- .5 Contractor is responsible for verifying quantities and take-offs.

### **1.5 Definitions**

- .1 HEPA Filter: High Efficiency Particulate Aerosol filter at least 99.97 percent efficient in collecting 0.3 micrometer aerosol.
  - .2 Friable Material: Material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
  - .3 Polyethylene Sheeting: Polyethylene sheeting 0.15 mm (6 mil) minimum thickness; with tape seals along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane protection.
  - .4 Authorized Visitor(s): Owner's Consultant or person(s) representing regulatory agencies, and person(s) authorized by them.
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- .5 Asbestos Work Area(s): Area(s) where work takes place which will, or may disturb asbestos-containing material, including overspray and fallen material, or settled dust that may contain asbestos.
- .6 Curtained Doorway: Device to allow ingress or egress from enclosure while permitting minimal air movement, typically constructed by placing 2 overlapping flaps of polyethylene sheeting (2 sheets of polyethylene per flap) attached to head and 1 jamb of existing or temporarily constructed door frame. Secure vertical edge of 1 flap along 1 vertical side of door frame, and vertical edge of other flap along opposite vertical side of door frame. Reinforce free edges of polyethylene with duct tape.
- .7 Negative Pressure: Reduced pressure within asbestos work area(s) established by extracting air directly from work area, and discharging directly to exterior of building. Discharged air first passes through HEPA filter. Extract sufficient air to ensure constant reduced pressure at perimeter of work area with respect to surrounding areas.
- .8 Airlock: 2 curtained doorways spaced minimum of 2 m (6') apart.

## 1.6 Regulations

- .1 Comply with Federal, Provincial, and local requirements pertaining to asbestos, provided that in any case of conflict among these requirements or with these specifications the more stringent requirement shall apply.
- .2 Comply with Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations made under The Occupational Health and Safety Act, Ontario Regulation 278/05.
- .3 Handle and dispose of contaminated waste as required under Ontario Regulation 558/00 made under The Environmental Protection Act.
- .4 Not later than ten days before commencing asbestos work on this project, notify in writing, Ontario Ministry of Labour, Construction Health and Safety Branch, that hazardous asbestos work area will exist. Notify orally before commencing work.
- .5 Notify sanitary landfill site in accordance with requirements of Ontario Regulation 558/00.
- .6 Contractor shall ensure that:
  - .1 Measures and procedures prescribed under the Occupational Health & Safety Act and regulations are carried out.
  - .2 Every employee and every worker on project complies with applicable act and regulations.
  - .3 Health & safety of workers and public are protected.
  - .4 All material handling, and associated equipment conform to and be operated in accordance with "Workplace Hazardous Materials Information System" (WHMIS).

- .7 Contractor may be requested to provide information on their health & safety record.

## **1.7 Quality Assurance**

- .1 Ensure work proceeds to Schedule and meets all requirements of this Section. Perform work so airborne asbestos, asbestos waste or water run off does not contaminate areas outside asbestos work enclosure.
- .2 Pay cost to Owner of inspection and air monitoring performed as result of failure to perform work satisfactorily.
- .3 Use only skilled and qualified workers for all trades required for this work.

## **1.8 Submittals**

- .1 Before commencing work
  - .1 Obtain and submit all necessary permits for transporting and disposal of asbestos waste.
  - .2 Submit names of supervisory personnel who will be responsible for asbestos work area(s). One of these supervisors must remain on Site at all times asbestos removal or clean-up is occurring. Submit proof that all personnel on-site have attended a training course and are certified asbestos trade workers through the Ministry of Training, Colleges and Universities. Submit proof that all supervisors have completed a supervisory course and are certified asbestos abatement supervisors through the Ministry of Training, Colleges and Universities and have performed supervisory function on at least 2 other asbestos removal projects.
  - .3 Submit proposed schedule showing phasing and proposed workforce related to each work area enclosure or repair operation.
  - .4 Submit list of existing damage for acceptance.
- .2 Laws of province of Ontario shall govern this work. Contractor shall observe all such laws and shall obtain and/or pay all permits, notices, fees, taxes, duties as may be required. Likewise, it is responsibility of contractor to comply with Workers Compensation and Occupational Health and Safety Act.
- .3 Before commencing any work, Contractor shall submit, in writing, confirmation of good standing with Workplace Safety and Insurance Board (WSIB).

## **1.9 Worker and Visitor Protection**

- .1 Instructions: Before entering asbestos work area(s), instruct workers and visitors in use of respirators, entry and exit from enclosures and all aspects of work procedures and protective measures. Instruction shall be provided by competent person as defined by Occupational Health and Safety Act.
- .2 Respirators: Provide respiratory equipment for all persons entering asbestos work area enclosure including authorized visitors. When doing work which will

or may disturb asbestos-containing materials, workers, supervisors, and authorized visitors must be supplied with and use non-powered full-face respirators with high efficiency (HEPA) cartridge filters. Filters once used shall be replaced daily or tested according to manufacturer's specifications and replaced as necessary. Respirators shall be acceptable to Occupational Health Branch of Ministry of Labour. Provide instruction to workers and visitors in use of respirators including qualitative fit testing. No supervisor, worker or authorized visitor shall wear facial hair which affects seal between respirator and face.

- .3 Protective Clothing: Provide workers and visitors in full-enclosure Sites with full body coveralls with integral hoods. Once coveralls are worn in asbestos work area, treat and dispose of as asbestos contaminated waste. Workers and visitors shall also wear other protective apparel required by Ministry of Labour construction regulations.
- .4 Before entering enclosure(s) put on respirator with new or tested filters, clean coveralls and head covers. Wear coveralls with hoods up at all times.
- .5 Workers may leave enclosure, only after all disturbance of asbestos-containing materials is complete and enclosure has been cleaned-up. When leaving enclosure workers and visitors use HEPA vacuum to clean exterior of respirator to remove visible contamination, and remove gross contamination from coveralls and other protective equipment. Immediately upon leaving enclosure workers and visitors shall remove coveralls and wash face and hands thoroughly with soap and water. Wet clean inside of respirator. Remove filters and dispose of or test filters according to manufacturer's specifications. Place coveralls and used filters in receptacles for disposal with other asbestos contaminated materials. Coveralls can be reused, to maximum of 8 hours wear, if coveralls remain inside work area.
- .6 Do not eat, drink, smoke or chew gum or tobacco in enclosures.
- .7 Workers and visitors shall be fully protected as specified herein whenever possibility of disturbance of asbestos exists.

## **2. PRODUCTS**

### **2.1 Materials**

- .1 Polyethylene Sheeting: 0.15 mm (6 mil) minimum thickness unless otherwise specified; in sheet size to minimize joints.
  - .2 Rip-Proof Polyethylene: 0.20 mm (8 mil) fabric made up from 0.13 mm (5 mil) weave and 2 layers 0.04 mm (1.5 mil) poly laminate, in sheet size to minimize joints.
  - .3 Tape: Tape suitable for sealing polyethylene to surface encountered under both wet conditions using amended water, and dry conditions.
  - .4 Wetting Agent: Non-sudsing surface active agent; mixed with water in concentration to provide thorough wetting of asbestos fibre: Asbesto-Wet, distributed by Hazmasters, Pickering, Ontario or equivalent.
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- .5 Amended Water: Water with wetting agent added.
- .6 Asbestos Waste Receptors: 2 separate containers of which 1 shall consist of 0.15 mm (6 mil) minimum thickness polyethylene bag. Other container may be 0.15 mm (6 mil) minimum thickness polyethylene bag or rigid sealable container such as metal or cardboard, fibre drum or wood box. Other container shall be adequate to prevent perforating rips, or tears in first container during filling, transport or disposal. Containers must be acceptable to disposal Site selected and Ministry of Environment.
- .7 Sealer: Sealer for purpose of trapping residual fibre debris. Product must have flame spread and smoke development ratings both less than 50. Product shall leave no stain when dry, and be compatible with new application of fireproofing/insulation.
- .8 Sprayer: Garden-type portable manual sprayer, low velocity, capable of producing mist or fine spray.
- .9 HEPA Vacuum: Vacuum with all necessary fittings, tools and attachments. Air must pass HEPA filter before discharge.

### **3. EXECUTION**

#### **3.1 Full-Enclosure Asbestos Work Areas**

- .1 Move equipment, tools, furnishings, and stored materials which can be moved without disturbing asbestos-containing materials.
  - .2 Request building personnel to shut off air handling and ventilation systems supplying or exhausting from asbestos work area enclosure(s). Ensure air handling systems remain shut off for duration of work.
  - .3 Erect wood framing between asbestos work area and remaining building area, as necessary to support polyethylene sheeting enclosures. Enclosures for access into ceilings shall extend to underside of ceiling system and may be supported from ceiling system. Free standing enclosure shall have completely sealed polyethylene top. Protect floors and carpets.
  - .4 Preclean with HEPA vacuum all wall and floor surfaces. Alternatively, cover existing floor and wall surfaces inside room serving as enclosure with polyethylene sheeting. Use sufficient layers to provide adequate protection. Protect floors with at least 1 layer of polyethylene sheeting. Where walls are protected with sheeting, cover floors first so that wall polyethylene overlaps floor layer by at least 300 mm (12"). Cover carpets with rip-proof polyethylene.
  - .5 Establish negative pressure in asbestos work area. Operate negative pressure units or HEPA vacuums continuously from this time until completion of contaminated work.
  - .6 Provide soap, water and towels for washing of worker's face and hands when exiting enclosure.
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- .7 Maintain emergency and fire exits from asbestos work area, or establish alternative exits satisfactory to authorities having jurisdiction.
- .8 Ensure existing power supply to asbestos work area is isolated and disconnected where necessary. Do not disrupt power supply to remainder of building.

### **3.2 Maintenance of Enclosures**

- .1 Maintain enclosures in tidy condition.
- .2 Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
- .3 Visually inspect enclosures at beginning of each working period.

### **3.3 Commence Asbestos Removal Work When**

- .1 Arrangements have been made for disposal of waste.
- .2 Asbestos work areas enclosures and parts of building required to remain in use are effectively segregated. Negative pressure equipment is operating continuously.
- .3 Tools, equipment and materials waste receptors are inside enclosure.
- .4 Arrangements have been made for work area security.
- .5 Signs are displayed in all areas where access to sealed asbestos work areas possible. Signs shall read:

#### **CAUTION**

Asbestos Hazard Area  
No Unauthorized Entry  
Wear assigned protective equipment  
Breathing asbestos dust may cause serious bodily harm.

- .6 Owner's Consultant has been notified of intention to proceed and has reviewed enclosures and equipment.

### **3.4 Asbestos Disturbance in Enclosure**

- .1 Before removing asbestos, prepare Site as described in articles 3.1, 3.2 and 3.3.
  - .2 Seal opening to enclosure with tape after entry of worker. Worker shall remain inside enclosure until disturbed asbestos-containing materials is complete and enclosure has been effectively cleaned.
  - .3 Perform work required inside enclosure.
-

- .4 When removing minor amounts of asbestos-containing materials from systems or surfaces within enclosure, spray asbestos-containing material with amended water. Saturate asbestos to prevent release of airborne fibres during removal. Remove fully saturated asbestos directly into waste containers. Do not allow asbestos to fall to floor of enclosure.
- .5 When removing pipe insulation, remove asbestos-containing pipe insulation in layers, maintaining exposed surfaces of insulation or lagging in wet condition.
- .6 When removing pipe insulation, seal ends of pipe and other mechanical insulation at perimeters of enclosure with heavy coat of high temperature sealer.
- .7 Treat materials removed as asbestos contaminated waste and dispose of as such. If materials or equipment removed to access asbestos are to be re-used (cladding, etc.), wet clean or vacuum as appropriate prior to reinstatement.
- .8 After completion of removal of asbestos, clean surfaces from which asbestos has been removed with stiff bristle brushes, vacuum, or wet-sponge if appropriate to remove all visible material.
- .9 Carefully place asbestos waste in inner bag of asbestos waste receptor. Clean inner bag of gross contamination and place in clean 6 mil outer bag. If waste is likely to tear inner bag, then instead of outer bag use fibre or metal drum, cardboard or wood box, or other suitably sturdy container.
- .10 After vacuuming to remove visible asbestos, wet clean entire enclosure, including equipment and floor and wall surfaces, ducts and similar items not covered with polyethylene sheeting. Apply heavy coat of sealer to all surfaces from which asbestos has been removed. Apply thinned coat (sufficient to coat all surfaces) to interior of polyethylene enclosure, or spray interior of enclosure with amended water immediately prior to tear down.

### **3.5 Tear Down of Protection**

- .1 All Type 2 enclosures shall be subject to clearance air monitoring by the Owner's Consultant. Do not dismantle any enclosures prior to approval by consultant.
  - .2 When dismantling enclosure, carefully roll polyethylene toward centre of enclosure. As polyethylene is rolled away, immediately remove any visible debris with HEPA vacuum.
  - .3 Place polyethylene sheeting seals, tape, cleaning material, coveralls, and other contaminated waste in asbestos waste receptors for transport. Remove any debris fallen behind plastic with HEPA vacuum.
  - .4 Clean up asbestos waste receptors and equipment used in work, and remove from asbestos work area(s) via drum and equipment decontamination enclosure systems, at appropriate time in sequence. Double bag waste immediately prior to transport from Site.
  - .5 Final review may be carried out by Owner's Consultant to ensure no dust or debris remains.
-

### **3.6 Re-Establishment of Objects and Systems**

- .1 When clean-up is complete reinstall items removed to facilitate asbestos related operation, in their proper positions. Reconstruction and reinstallation shall be by tradesmen qualified in work being reinstalled or reconstructed.
- .2 Re-establish mechanical and electrical systems to remain operative in proper working order. Arrange for, and pay costs of, electrical or mechanical repairs needed due to this work.
- .3 At completion of work make good all damage not identified in pre-removal survey referred to in the submittals section.

### **3.7 Air Monitoring**

- .1 In addition to clearance air monitoring for each enclosure, Owner's Consultant may arrange for air samples to be taken from commencement of work until completion of cleaning operations, both inside (if required) and outside of asbestos work area(s) enclosures in accordance with NIOSH methods or with Fibrous Aerosol Monitor.
- .2 If air monitoring or visual inspection indicates that areas outside current asbestos work area enclosures are contaminated above 0.01 fibre/mL clean these areas in same manner as that applicable to asbestos work areas, at no cost to Owner.
- .3 If air sampling by Owner's Consultant shows that levels in asbestos work area do not exceed 0.01 fibres/mL as determined by NIOSH 7400 Method A counting rules, proceed with dismantling of enclosures.
- .4 Clearance level is 0.01 f/cc.

### **3.8 Waste Transport and Disposal**

- .1 Conform to requirements of Regulation 558/00 under Environmental Protection Act for Waste Management, transporting and disposal of hazardous waste.
- .2 Obtain Certificate of Approval from Ministry of Environment for waste management disposal system for asbestos.
- .3 Check with landfill operator to determine type of waste containers acceptable.
- .4 Ensure shipment of containers to landfill is taken by waste hauler licensed to transport asbestos waste.
- .5 Each load requires completion of bill of lading showing type and weight of hazardous waste being transported.
- .6 Co-operate with Ministry of Environment inspectors and immediately carry out instructions for remedial work at landfill to maintain environment, at no additional cost to Owner.
- .7 Ensure landfill operator is fully aware of hazardous material being landfilled.

END OF SECTION



## **PART 1 GENERAL**

### **1.1 SUMMARY**

- .1 Comply with requirements of this Section when performing following Work:
  - .1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap on ceilings and walls.
  - .2 Removal of lead-containing coatings or materials using a power tool with an effective dust collection system equipped with a HEPA filter on ceilings and walls.
  - .3 Removal of lead-containing coatings or materials with non-powered hand tool, other than manual scraping and sanding on ceilings and walls.

### **1.2 RELATED REQUIREMENTS**

- .1 Section 02 83 11 – Lead Based Paint Abatement – Intermediate Precautions

### **1.3 REFERENCE STANDARDS**

- .1 Department of Justice Canada
  - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .2 Health Canada
  - .1 Workplace Hazardous Materials Information System (WHMIS), Material Safety Data Sheets (MSDS).
- .3 Human Resources and Social Development Canada (HRSDC)
  - .1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.
- .4 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .5 U.S. Environmental Protection Agency (EPA)
  - .1 EPA 747-R-95-007-1995, Sampling House Dust for Lead.
- .6 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (NIOSH)
  - .1 NIOSH 94-113 - NIOSH Manual of Analytical Methods (NMAM), 4th Edition (1994).
- .7 U.S. Department of Labour - Occupational Safety and Health Administration (OSHA) - Toxic and Hazardous Substances
  - .1 Lead in Construction Regulation - 29 CFR 1926.62-1993.
- .8 Underwriters' Laboratories of Canada (ULC)

#### 1.4 DEFINITIONS

- .1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .2 Authorized Visitors: Consultant and Departmental Representative or designated representatives.
- .3 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects over cuts and tears, and elsewhere as required to provide protection and isolation. For protection of underlying surfaces from damage and to prevent lead dust entering in clean area.
- .4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.
- .5 Action level: employee exposure, without regard to use of respirators, to airborne concentration of lead of 50 micrograms per cubic metre of air (50 ug/m<sup>3</sup>) calculated as 8-hour time-weighted average (TWA). Minimum precautions for lead abatement are based on airborne lead concentrations less than 0.05 milligrams per cubic metre of air for removal of lead based paint by methods noted in paragraph 1.1.
- .6 Competent person: Consultant capable of identifying existing lead hazards in workplace taking corrective measures to eliminate them.
- .7 Lead dust: wipe sampling on vertical surfaces and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.

#### 1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide proof satisfactory to Consultant that suitable arrangements have been made to dispose of lead based paint waste in accordance with requirements of authority having jurisdiction.
- .2 Provide proof of Environmental Liability and Contractor's General Insurance.
- .3 Quality Control:
  - .1 Provide Consultant necessary permits for transportation and disposal of lead based paint waste and proof that lead based paint waste has been received and properly disposed.
  - .2 Provide proof satisfactory to Consultant that employees have had instruction on hazards of lead exposure, respirator use, dress, and aspects of work procedures and protective measures.

## 1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to lead paint, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Health and Safety:
  - .1 Safety Requirements: worker and visitor protection.
    - .1 Protective equipment and clothing to be worn by workers and visitors in work Area include:
      - .1 Respirator NIOSH approved and equipped with replaceable HEPA filter cartridges with an assigned protection factor of 10, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure. Provide sufficient amount of filters.
      - .2 Half mask respirator: half-mask particulate respirator with P- series filter, and 100% efficiency could be provided.
    - .2 Eating, drinking, chewing, and smoking are not permitted in work area.
    - .3 Ensure workers wash hands and face when leaving work area.
    - .4 Visitor Protection:
      - .1 Provide approved respirators to Authorized Visitors to work areas.
      - .2 Instruct Authorized Visitors procedures to be followed in entering and exiting work area.

## 1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .2 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of lead waste in sealed double thickness 6ml bags or leak proof drums. Label containers with appropriate warning labels.
- .3 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

## 1.8 EXISTING CONDITIONS

- .1 Reports and information pertaining to lead based paint to be handled, removed, or otherwise disturbed and disposed of during this Project are available for inspection.
- .2 Notify Consultant of lead based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Consultant.

## **1.9 SCHEDULING**

- .1 Not later than two days before beginning Work on this Project notify following in writing:
  - .1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.
  - .2 Provincial Ministry of Labour.
  - .3 Disposal Authority.
- .2 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.
- .3 Provide Consultant copy of notifications prior to start of Work.

## **1.10 PERSONNEL TRAINING**

- .1 Provide Consultant satisfactory proof that every worker has had instruction and training in hazards of lead exposure, in personal hygiene, in aspects of work procedures, and in use, cleaning, and disposal of respirators.
- .2 Instruction and training related to respirators includes, at minimum:
  - .1 Proper fitting of equipment.
  - .2 Inspection and maintenance of equipment.
  - .3 Disinfecting of equipment.
  - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.
- .4 Supervisory personnel to complete required training.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Polyethylene 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.
- .2 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.
- .3 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual lead paint residue.
- .4 Lead waste containers: fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm thickness sealable polyethylene liners.
  - .1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

## **PART 3 EXECUTION**

### **3.1 SUPERVISION**

- .1 One Supervisor for every ten workers is required.
- .2 Supervisor must remain within work area during disturbance, removal, or handling of lead based paints.

### **3.2 PREPARATION**

- .1 Remove and store items to be salvaged or reused.
  - .1 Protect and wrap items and transport and store in area specified by Consultant.
- .2 Work Area:
  - .1 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.
  - .2 Pre-clean fixed casework and equipment within work area, using HEPA vacuum and cover and seal with polyethylene sheeting and tape.
  - .3 Clean work area using HEPA vacuum. If not practicable, use wet cleaning method. Do not raise dust.
  - .4 Seal off openings with polyethylene sheeting and seal with tape.
  - .5 Protect floor surfaces covered from wall to wall with polyethylene sheets.
  - .6 Maintain emergency fire exits or establish alternatives satisfactory to Authority having jurisdiction.
  - .7 Where water application is required for wetting lead containing materials, provide temporary water supply appropriately sized for application of water as required.
  - .8 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical cables and equipment.
- .3 Do not start work until:
  - .1 Arrangements have been made for disposal of waste.
  - .2 Tools, equipment, and materials waste containers are on site.
  - .3 Arrangements have been made for building security.
  - .4 Notifications have been completed and preparatory steps have been taken.

### **3.3 LEAD ABATEMENT**

- .1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap; or removal equipped with HEPA filters; or removal with using power tools non-powered hand tool, other than manual scraping and sanding.

- .2 Remove lead based paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.
- .3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to staging area. Clean external surfaces thoroughly again by wet sponging. Wash containers thoroughly pending removal to outside. Ensure containers are removed by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .4 After completion of stripping work, wire brush and wet sponge surface from which lead based paint has been removed to remove visible material. During this work keep surfaces wet.
- .5 After wire brushing and wet sponging to remove visible lead based paint, and after encapsulating lead containing material impossible to remove, wet clean entire work area, and equipment used in process. After inspection by Consultant apply continuous coat of slow drying sealer to surfaces of work area. Do not disturb work area for 8 hours no entry, activity, ventilation, or disturbance during this period.

### 3.4 INSPECTION

- .1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from these requirements not approved in writing by Consultant will result in work stoppage, at no cost to Owner.
- .2 Consultant will inspect work for:
  - .1 Adherence to specific procedures and materials.
  - .2 Final cleanliness and completion.
  - .3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

### 3.5 LEAD SURFACE SAMPLING - WORK AREAS

- .1 Final lead surface sampling to be conducted as follows:
  - .1 After work area has passed a visual inspection for cleanliness approved and accepted by Consultant. Apply coat of lock-down agent to surfaces within enclosure, and appropriate setting period of 8 hours has passed, Consultant will perform lead wipe sampling.
    - .1 Final lead wipe sampling results from horizontal and vertical surfaces must show lead levels of less than 40 micrograms of lead in dust per square foot. Samples collected and analyzed in accordance with EPA 747-R-95-007.
    - .2 If wipe sampling results show levels of lead in excess of 40 micrograms per square foot, re-clean work area at contractor's expense and apply another acceptable coat of lock-down agent to surfaces.
    - .3 Repeat as necessary until fibre levels are less than 40 micrograms per square foot.

**3.6 FINAL CLEANUP**

- .1 Following cleaning and when lead wipe surfaces sampling are below acceptable concentrations, proceed with final cleanup.
- .2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum.
- .3 Place polyethylene sheets, tape, cleaning material, clothing, and contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .4 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

**3.7 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS**

- .1 Repair or replace objects damaged in course of work to their original state or better, as directed by Consultant.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SUMMARY**

- .1 Comply with requirements of this Section when performing following Work:
  - .1 Removal of lead based paint from walls and ceilings by scraping or sanding using non-powered hand tools.
  - .2 Manual demolition of lead-painted plaster walls or building components by striking wall with sledgehammer or similar tool.

**1.2 RELATED REQUIREMENTS**

- .1 Section 02 83 10 – Lead Based Paint Abatement – Minimum Precautions

**1.3 REFERENCE STANDARDS**

- .1 Department of Justice Canada
  - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .2 Health Canada
  - .1 Workplace Hazardous Materials Information System (WHMIS), Material Safety Data Sheets (MSDS).
- .3 Human Resources and Social Development Canada (HRSDC)
  - .1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.
- .4 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .5 U.S. Environmental Protection Agency (EPA)
  - .1 EPA 747-R-95-007-1995, Sampling House Dust for Lead.
- .6 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (NIOSH)
  - .1 NIOSH 94-113 - NIOSH Manual of Analytical Methods (NMAM), 4th Edition (1994).
- .7 U.S. Department of Labour - Occupational Safety and Health Administration (OSHA) - Toxic and Hazardous Substances
  - .1 Lead in Construction Regulation - 29 CFR 1926.62-1993.
- .8 Underwriters' Laboratories of Canada (ULC)



## 1.4 DEFINITIONS

- .1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .2 Authorized Visitors: Owner, Consultant or designated representatives and representatives of regulatory agencies.
- .3 Occupied Area: areas of building or work site that is outside Work Area.
- .4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.
- .5 Airlock: ingress or egress system, without permitting air movement between contaminated area and uncontaminated area. Consisting of two curtained doorways at least 2 m apart.
- .6 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another. Typically constructed as follows:
  - .1 Place two overlapping polyethylene sheets over existing or temporarily framed doorway, securing each along top of doorway, securing vertical edge of one sheet along one vertical side of doorway, and secure other sheet along opposite vertical side of doorway.
  - .2 Reinforce free edges of polyethylene with duct tape and add weight to bottom edge to ensure proper closing.
  - .3 Overlap each polyethylene sheet at openings 1.5 m on each side.
- .7 Action level: employee exposure, without regard to usage of respirators, to an airborne concentration of lead of 50 micrograms per cubic metre of air calculated as 8 hour time-weighted average (TWA). Intermediate precautions for lead abatement are based on airborne lead concentrations greater than 0.05 milligrams per cubic metre of air within Work Area.
- .8 Competent person: Consultant capable of identifying existing lead hazards in workplace and taking corrective measures to eliminate them.
- .9 Lead in Dust: wipe sampling on vertical and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.

## 1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide proof satisfactory to Consultant that suitable arrangements have been made to dispose of lead based paint waste in accordance with requirements of authority having jurisdiction.
- .2 Provide: Provincial requirements for Notice of Project Form.
- .3 Provide proof of Contractor's General and Environmental Liability Insurance.

- .4 Quality Control:
  - .1 Provide Consultant necessary permits for transportation and disposal of lead based paint waste and proof that it has been received and properly disposed.
  - .2 Provide proof satisfactory to Consultant that employees have had instruction on hazards of lead exposure, respirator use, dress, entry and exit from Work Area, and aspects of work procedures and protective measures.
  - .3 Provide proof that supervisory personnel have attended lead abatement course, of not less than two days duration, approved by Consultant. Minimum of one supervisor for every ten workers.
- .5 Product data:
  - .1 Provide documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:
    - .1 Encapsulants.
    - .2 Amended water.
    - .3 Slow drying sealer.

## 1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to lead paint, in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Health and Safety:
  - .1 Safety Requirements: worker and visitor protection.
    - .1 Protective equipment and clothing to be worn by workers and visitors in Work Area includes:
      - .1 Respirator NIOSH approved and equipped with filter cartridges with assigned protection factor of 50 acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure in Lead Work Area. Provide sufficient filters so workers can install new filters following disposal of used filters and before re-entering contaminated areas.
      - .2 Disposable type protective clothing that does not readily retain or permit skin contamination, consisting of full body covering including head covering with snug fitting cuffs at wrists, ankles, and neck.
    - .3 Requirements for workers:

- .4 Remove street clothes in clean change room and put on respirator with new filters or reusable filters, clean coveralls and head covers before entering Equipment and Access Rooms or Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.
- .5 Remove gross contamination from clothing before leaving work area. Place contaminated work suits in receptacles for disposal with other lead - contaminated materials. Leave reusable items except respirator in Equipment and Access Room. When not in use in Work Area, store work footwear in Equipment and Access Room. Upon completion of lead abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from Work Area or from Equipment and Access Room.
- .6 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers not to use this system as means to leave or enter work area.
- .2 Eating, drinking, chewing, and smoking are not permitted in Work Area.
- .3 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual lead abatement.
- .4 Ensure workers wash hands and face when leaving Work Area.
- .5 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.
- .6 Ensure no person required to enter Work Area has facial hair that affects seal between respirator and face.
- .7 Visitor Protection:
  - .1 Provide protective clothing and approved respirators to Authorized Visitors to Work Areas.
  - .2 Instruct Authorized Visitors in use of protective clothing, respirators and procedures.
  - .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Work Area.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .2 Disposal of lead waste generated by removal activities must comply with Provincial and Federal regulations. Dispose of lead waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.
- .3 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

## **1.8 EXISTING CONDITIONS**

- .1 Reports and information pertaining to lead based paint to be handled, removed, or otherwise disturbed and disposed of during this Project are available for inspection
- .2 Notify Consultant of lead based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Consultant.

## **1.9 SCHEDULING**

- .1 Not later than two days before beginning Work on this Project notify the following in writing, where appropriate:
  - .1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.
  - .2 Provincial Ministry of Labour.
  - .3 Disposal Authority.
- .2 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.
- .3 Provide Consultant copy of notifications prior to start of Work.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- .1 Polyethylene: 0.15 mm unless otherwise specified; in sheet size to minimize joints.
- .2 FR polyethylene: 0.15 mm woven fibre reinforced fabric bonded both sides with polyethylene.
- .3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.
- .4 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for trapping residual lead paint residue.

- .5 Lead waste containers: fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm sealable polyethylene liners.

- .1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

## **PART 3 EXECUTION**

### **3.1 SUPERVISION**

- .1 Approved Supervisor must remain within Lead Work Area during disturbance, removal, or other handling of lead based paints.

### **3.2 PREPARATION**

- .1 Remove and wrap items to be salvaged or reused, and transport and store in area specified by Consultant.
- .2 Work Area:
  - .1 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.
  - .2 Pre-clean fixed casework, and equipment within work areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.
  - .3 Clean work areas using HEPA vacuum. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum.
  - .4 Seal off openings, corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.
  - .5 Cover floor surfaces in work area from wall to wall with FR polyethylene drop sheets to protect existing floor during removal.
  - .6 Build airlocks at entrances and exits from work areas to ensure work areas are always closed off by one curtained doorway when workers enter or exit.
  - .7 At point of access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used:
    - .1 CAUTION LEAD HAZARD AREA (25 mm).
    - .2 NO UNAUTHORIZED ENTRY (19 mm).
    - .3 WEAR ASSIGNED PROTECTIVE EQUIPMENT AND RESPIRATOR (19 mm).
    - .4 BREATHING LEAD CONTAMINATED DUST CAUSES SERIOUS BODILY HARM (7 mm).
  - .8 Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Authority having jurisdiction.

- .9 Where water application is required for wetting lead containing materials, provide temporary water supply by use of appropriately sized hoses for application of water as required.
- .10 Provide electrical power and shut off for operation of powered tools and equipment. Provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.
- .3 Worker Decontamination Enclosure System:
  - .1 Worker Decontamination Enclosure System includes Equipment and Access Room and Clean Room, as follows:
    - .1 Equipment and Access Room: construct between exit and work areas, with two curtained doorways, one to the rest of suite, and one to work area. Install waste receptor and storage facilities for workers' shoes and protective clothing to be re-worn in work areas. Build large enough to accommodate specified facilities, equipment needed, and at least one worker allowing sufficient space to change comfortably.
    - .2 Clean Room: construct with curtained doorway to outside of enclosures. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.
- .4 Construction of Decontamination Enclosures:
  - .1 Construct framing for enclosures or use existing rooms. Line enclosure with polyethylene sheeting and seal with tape, apply two layers of FR polyethylene on floor.
  - .2 Construct curtain doorways between enclosures so when people move through or waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.
- .5 Separation of Work Areas from Occupied Areas
  - .1 Barriers between Work Area and occupied area to be constructed as follows:
    - .1 Construct floor to ceiling lumber stud framing, cover with polyethylene sheeting and seal with duct tape. Apply plywood over polyethylene sheeting. Seal plywood joints and between adjacent materials with surface film forming sealer, to create airtight barrier.
    - .2 Cover plywood with polyethylene sheeting and sealed with duct tape.

- .6 Maintenance of Enclosures:
  - .1 Maintain enclosures in clean condition.
  - .2 Ensure barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately.
  - .3 Visually inspect enclosures at beginning of each work day.
  - .4 Use smoke test method to test effectiveness of barriers as directed by Consultant.

### 3.3 LEAD - BASE PAINT ABATEMENT

- .1 Removal of lead based paint to be performed by scraping or sanding using non-powered hand tools, or manual demolition of lead-painted plaster walls or building components by striking a wall with sledgehammer or similar tool.
- .2 Remove lead based paint in small sections and pack as it is being removed in sealable 0.15mm plastic bags and place in labelled containers for transport.
- .3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .4 After completion of stripping work, wire brush and wet sponge surface from which lead based paint has been removed to remove visible material. During this work keep surfaces wet.
- .5 After wire brushing and wet sponging to remove visible lead based paint, and after encapsulating lead containing material impossible to remove, wet clean work area including equipment and access room, and equipment used in process. After inspection by Consultant, apply continuous coat of slow drying sealer to surfaces. Do not disturb work for 8 hours with no entry, activity, ventilation or disturbance during this period.
- .6 After enclosing lead painted surfaces, wet clean work area and equipment and access room. During settling period no entry, activity, or ventilation will be permitted.

### 3.4 INSPECTION

- .1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from these requirements not approved in writing by Consultant will result in work stoppage, at no cost to Owner.

- .2 Consultant will inspect work for:
  - .1 Adherence to specific procedures and materials.
  - .2 Final cleanliness and completion.
  - .3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.
- .3 When lead dust leakage from Work Area occurs Consultant may order Work shutdown.
  - .1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

### 3.5 LEAD SURFACE SAMPLING - WORK AREAS

- .1 Final lead surface sampling to be conducted as follows:
  - .1 After Work Area has passed a visual inspection for cleanliness approved by Consultant and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period of 8 hours has passed. Consultant will perform lead wipe sampling in Work Area.
    - .1 Final lead wipe sampling results from horizontal and vertical surfaces where lead based paints have been removed must show lead levels of less than 40 micrograms of lead in dust per square foot. Samples must be collected and analyzed in accordance with EPA 747-R-95-007.
    - .2 If wipe sampling results show levels of lead in excess of 40 micrograms per square foot, re-clean work area at contractor's expense and apply another acceptable coat of lock-down agent to surfaces.
    - .3 Repeat as necessary until fibre levels are less than 40 micrograms per square foot.

### 3.6 FINAL CLEANUP

- .1 Following specified cleaning procedures, and when lead wipe sampling is below acceptable concentrations proceed with final cleanup.
- .2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum equipment.
- .3 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .4 Clean-up Work Areas, Equipment and Access Room, and other contaminated enclosures.
- .5 Clean-up sealed waste containers and equipment used in Work and remove from work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.



- .6 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

### **3.7 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS**

- .1 Repair or replace objects damaged in course of work to their original state or better, as directed by Consultant.

**END OF SECTION**

SECTION	NUMBER	NAME	PAGES
	21 05 00.00	General Instructions for Mechanical Sections	6
	21 05 01.00	Abbreviations	4
	21 05 02.00	Record Drawings	2
	21 05 03.00	Shop Drawings	1
	21 05 29.00	Hangers and Supports	3
	21 05 88.00	Cutting and Patching	2
	21 07 00.00	Mechanical Insulation	4
	22 05 76.00	Cleanouts	1
	22 11 13.00	Pipes, Valves and Fittings (Plumbing System)	2
	23 05 93.26	Testing and Balancing Air Systems	2
	23 09 00.00	Building Automation System (BAS)	4
	23 09 23.00	Sequence of Operation for BAS	1
	23 23 00.00	Refrigerant Pipes, Valves, Fittings & Equipment	2
	23 31 13.00	Ductwork and Specialities	5
	23 34 63.00	Roof Exhaust Fans	2
	23 37 13.00	Diffusers, Grilles and Registers	2
	23 81 26.00	Unitary Air Conditioning Units	2
	23 84 13.00	Humidifiers	2

END OF SECTION 21 00 00.00

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Conform to the requirements of Division 1, which applies to and forms part of all sections of the work.
    - 1.1.2. The Specification is divided into Sections which are not intended to identify contractual limits between Sub-Contractors nor between the Contractor and his Sub-Contractors. The requirements of any one Section apply to all Sections. Refer to other Divisions and Sections to ensure a complete and operational system.
    - 1.1.3. Provide mechanical components and accessories which may not be specifically shown on the Drawings or stipulated in the Specifications, but are required to ensure complete and operational systems.
    - 1.1.4. The Drawings and Specifications shall be read in conjunction with base building drawings and specifications. The base building design documents are available for review at the Building Managers Office. The most stringent requirements will apply.
    - 1.1.5. Where the Specification Sections make mention of the "Owner" the contractor shall assume this to also mean "Landlord, or Lessor".
  - 1.2. INTENT
    - 1.2.1. Mention in the Specifications or indication on the Drawings of equipment, materials, operation and methods, requires provision of the quality noted, the quantity required, and the systems complete in every respect.
    - 1.2.2. The Specifications are an integral part of the accompanying Drawings. Any item or subject omitted from one or the other, but which is either mentioned or reasonably implied, shall be considered as properly and sufficiently specified.
    - 1.2.3. Be completely responsible for the acceptable condition and operation of all systems, equipment and components forming part of the installation or directly associated with it. Promptly replace defective material, equipment and part of equipment and repair related damages.
  - 1.3. SECTIONS AFFECTED
    - 1.3.1. These instructions apply to and form a part of all Mechanical Sections.
  - 1.4. REGULATIONS
    - 1.4.1. Work shall be performed in accordance with codes, rules, regulations, by-laws and requirements of the authorities having jurisdiction.
    - 1.4.2. The plumbing and drainage systems shall comply with regulations respecting plumbing made under the Ontario Water Resources Act except as modified by rules, regulations and by-laws of authorities having jurisdiction.
    - 1.4.3. Drawings and specifications should not conflict with the above regulations but where there are apparent discrepancies the Contractor shall notify the Consultant.
  - 1.5. PERMITS, FEES INSPECTION
    - 1.5.1. Obtain all permits, make submissions, pay all fees and arrange for all inspections required for the work of this Division.

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1.6. EXAMINATION OF SITE

- 1.6.1. Locate all existing services that are to be extended and the routing of new services shall be coordinated with all Trades prior to installation.

1.7. DRAWINGS, CHANGES AND INSTALLATION

- 1.7.1. The Drawings shall be considered to show the general character and scope of the work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operational installation.
- 1.7.2. The location, arrangement and connection of equipment and material as shown on the Drawings represents a close approximation to the intent and requirements of the work. The right is reserved by the Consultant to make reasonable changes required to accommodate conditions arising during the progress of the work, at no extra cost to the Owner.
- 1.7.3. In order to show more clearly the arrangement of the work, plans and sections do not show every valve, thermometer, pressure gauge or other system accessory. Refer to the Mechanical Standard Details and to the Specifications to determine the requirements.
- 1.7.4. Certain Details indicated on the Drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details shall be applicable to every occurrence.
- 1.7.5. All piping and ductwork in finished areas shall be chased into walls. No exposed piping or ductwork shall be installed in such areas unless specifically reviewed and accepted by the Consultant.
- 1.7.6. Exhaust fan or other mechanical equipment mounted on the loading dock canopy, or housing for such equipment shall not be closer to the edge of the roof than a distance equal to the height of the pipe, hood or equipment, unless specifically reviewed and accepted by the Consultant.
- 1.7.7. The location and size of existing services shown on the Drawings are based on the best available information. The actual location of existing services shall be verified in the field before work is commenced. Particular attention shall be paid to buried services.
- 1.7.8. Changes and modifications necessary to ensure co-ordination and to avoid interference and conflicts with other Trades, or to accommodate existing conditions, shall be made at no extra cost to the Owner.
- 1.7.9. Leave areas clear of piping and ducts where space is indicated as reserved for future equipment and equipment for other Trades.
- 1.7.10. Adequate space and provisions shall be left for removal of coils and servicing of equipment, with minimum inconvenience to the operation of systems.
- 1.7.11. Before fabricating ductwork or piping for installation, make certain that such items can be installed as shown on the Drawings without interfering with the structure or the work of other Trades. Any problems that cannot be solved in agreement with the other Trades affected, shall be submitted for decision. If ductwork or piping is prefabricated prior to the investigation and reaching of a solution to possible interference problems, necessary changes in such prefabricated items shall be made at no extra cost to the Owner.
- 1.7.12. Location of equipment shown on plans is diagrammatic. Layout of each device in finished areas is critical in terms of symmetry and location. Refer to Architectural or Interior Design Drawings and to site instructions in all regards. Any work not installed in the correct location (at the sole discretion of the Consultant) shall be remedied by this Contractor at his expense. This Contractor is responsible for mark-out of his work, fully co-ordinated with all other trades, in sufficient time for review by Consultant prior to rough-in. All mechanical and sprinkler services shall be located precisely.

1.8. MATERIALS

- 1.8.1. Materials and equipment supplied by this Division shall be new and free from defects and shall be as specified by the manufacturer's name and catalogue reference.
- 1.8.2. Where a certain manufacturer's equipment has been specified by name or model number, the Contractor shall be responsible for ensuring that the performance and quality of any proposed alternative meets the specified equipment and that the same access or maintenance space is available for the alternative manufacturer's equipment and that piping, duct and electrical connections can be made at no extra cost to the Contract.

1.9. CO-OPERATION WITH OTHER DIVISIONS

- 1.9.1. Particular attention must be paid to the proximity of electrical conduit and cable to mechanical piping and equipment.
- 1.9.2. Pipes transporting hot fluids shall be installed at least 150 mm (6 in.) away from pipes carrying cold fluids, unless approval from the Consultant is obtained to install services closer than 150 mm (6 in.).
- 1.9.3. Electrical conduits shall not touch or be supported from piping or ductwork.
- 1.9.4. Each Section shall confine itself to installing all materials in the spaces shown without encroaching upon space for materials installed under other Sections or Divisions. Where the space allocated to another Section or Division is encroached upon, the materials shall be relocated to their proper space allocation in such a manner to complete the work using space allocated to the various Sections and Divisions. Relocation of materials and work involved shall be paid for by the Section responsible for the encroachment at no extra cost to the Owner.
- 1.9.5. Supply all items to be built in ample time for rapid progress of the work. Schedule and proceed with work as required to satisfy the construction schedule.
- 1.9.6. The Contractor shall confirm the available voltage for all single phase and three phase motors or other similar electrically driven equipment with the Electrical Division prior to ordering the equipment. Any discrepancy between the requirements identified within the Contract Documents and those of the Electrical Division shall be reported to the Consultant and the equipment shall be adjusted to suit the appropriate power requirements. Failure to perform this coordination prior to ordering of the motors or equipment shall result in correction at no additional cost to the Owner.

1.10. TEMPORARY USE OF EQUIPMENT

- 1.10.1. Where the mechanical systems are operated during construction, the Mechanical Contractor shall maintain the system and equipment in proper operating condition.
- 1.10.2. Prior to application for substantial performance of the work as certified by the Consultant, the systems and equipment shall be returned to the initial new condition by replacing used air filters with new air filters, cleaning the air side of all coils in the air handling systems, replacing used belts in belt drives with new belts, lubricating all bearings according to manufacturer's factory standards and adjusting the thermostatic control system according to specifications and/or to suit the Owner.

1.11. EXISTING SERVICES AND EQUIPMENT

- 1.11.1. All changes and connections to existing services shall be made only in a manner and at a time approved by the Consultant so as to avoid any interruption of such services during normal working hours. If necessary, changes and connections to existing services shall be made outside of normal working hours, at no extra cost to the Contract.

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- 1.11.2. Whenever existing services or equipment are to be removed, all piping and ductwork for such services or equipment shall be removed back to the main, nearest pipe or duct and any open ends securely capped or plugged in an approved manner unless otherwise shown. If necessary to facilitate installation of new work, any existing services and equipment shall be removed and then replaced by this Division.
- 1.11.3. Whenever it becomes necessary to relocate existing piping, ductwork or equipment to make possible installation of the work under this Contract, such relocation shall be done by this Division without additional cost to the Contract.
- 1.11.4. Where connections are made to existing services, existing insulation shall be made good under this Division.
- 1.12. INTERRUPTION OF SERVICES
- 1.12.1. Any interruption of the mechanical services to any part of the building shall come at a time agreeable to the Consultant and Landlord. Make all necessary arrangements with those concerned and include for any overtime required to ensure that the interruption is held to a minimum.
- 1.13. STATEMENT OF PRICES
- 1.13.1. For the purpose of progress applications the Contractor shall submit a statement of his estimated prices for the various portions of the work, including labour, materials and equipment shown separately. The total price of all portions of the work shall equal the total price of the work covered under the Mechanical Division.
- 1.13.2. The Contractor shall submit the breakdown of work for this Contract to the Consultant for review and approval. The breakdown shall be in sufficient detail to enable the Consultant to evaluate the progress of work and shall identify all major equipment, components and sub trades.
- 1.14. METRIC CONVERSIONS
- 1.14.1. Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, but not limited to, equipment, pipes, ductwork and site services in both new and existing installations.
- 1.14.2. Conform to the Canadian Metric Practice Guide CSA-CAN3-2234-1-89
- 1.15. SCHEDULE, ACCESS, PROTECTION AND CLEAN-UP
- 1.15.1. The construction schedule places restrictions on the duration of construction within areas and the duration of shut-down of equipment. Refer to the General Conditions for all requirements.
- .1 All work shall be done in accordance with the approved construction schedule and all specified interim schedules. Contractor must comply with the General Contractor's Construction Schedule.
- 1.15.2. Access to the site is limited to location and time of day. Access to areas of the building is limited to location and time of day. Refer to the General Conditions and conform to all requirements.
- 1.15.3. Refer to the security and protection requirements in the General Conditions and conform to all requirements. In particular no open flames shall be used without prior written approval of the Owner. There shall be no smoking, and the site shall be kept clean at all times.
- 1.16. HOUSEKEEPING PADS, CURBS AND SUPPORT PIERS

- 1.16.1. Provide concrete housekeeping pads, curbs and support piers under all floor mounted mechanical equipment and around all floor penetrations for pipes and ducts. Housekeeping pads and curbs shall be minimum 100 mm (4 in.) high unless detailed otherwise. Refer to the Drawings and Details for additional information.
  - 1.17. ASHRAE 90.1
  - 1.17.1. All mechanical equipment shall comply with the minimum efficiency standards set out in ASHRAE 90.1 and the Model National Energy Code of Canada for Buildings. Submit all necessary information to substantiate conformance.
  - 1.18. HOISTING FACILITIES
  - 1.18.1. This Division shall provide its own hoisting facilities.
  - 2. Products
  - 2.1. NOT USED
  - 3. Execution
  - 3.1. NOT USED
- END OF SECTION 21 05 00.00

1. General

1.1. ABBREVIATIONS

1.1.1. Generally, the following abbreviations are used in this Division:

A.A.B.C.	-	Associated Air Balance Council
AAP	-	Alarm Annunciator Panel
A.B.M.A.	-	American Boiler Manufacturers Association
ACO	-	Acid Resistant Cleanout
AD	-	Acid Resistant Drawings
AFD	-	Acid Resistant Floor Drain
AFF	-	Above Finished Floor
A.G.A.	-	American Gas Association
A.M.C.A.	-	Air Moving and Conditioning Association
A.N.S.I.	-	American National Standards Institute
A.R.I.	-	Air-Conditioning and Refrigeration Institute
A.S.H.R.A.E.	-	American Society of Heating, Refrigerating and Air Conditioning Engineers
A.S.M.E.	-	American Society of Mechanical Engineers
A.S.T.M.	-	American Society for Testing and Materials
AV	-	Acid Resistant Vent
A.W.G.	-	American Wire Gauge
AWS	-	American Welding Society
A.W.W.A.	-	American Water Works Association
B.H.P.	-	Boiler Horsepower or Brake Horsepower
Btu/hr	-	British Thermal Units per Hour
B.W.G.	-	British Wire Gauge
CAD	-	Computer Aided Drafting
CAFV	-	Controllable Air Flow Venturis
CAP	-	College of American Pathologists
CCA	-	Chromated Copper Arsenate
C.E.M.A.	-	Canadian Electrical Manufacturer's Association
CEMS	-	Central Energy Management System
CCF	-	Central Computer Facility
cfm	-	Cubic Feet per Minute
C.G.A.	-	Canadian Gas Association
C.G.S.B.	-	Canadian General Standards Board
C.I.	-	Cast Iron
CPU	-	Central Processing Unit
C.R.N.	-	Canadian Registration Number
CSA	-	Canadian Standards Association
cu.m.	-	Cubic Feet
cu.m.	-	Cubic Meter
db	-	Dry Bulb
dB	-	Decibel
dBA	-	A-weighted Decibel
DDC	-	Direct Digital Control
deg. C	-	Degrees Celsius
deg. F.	-	Degree Fahrenheit
dia.	-	Diameter
DPDT	-	Double Pull Double Throw
DPTX	-	Differential Pressure Transmitters
EAP	-	Excess Exhaust Alarm Panel



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E.D.R.	-	Equivalent Direct Radiation
EF	-	Exhaust Fan
E.E.M.A.C.	-	Electrical and Electronic Manufacturers Association of Canada
EEPROM	-	Electrically Erasable Programmable Read-Only Memory
EMT	-	Electrical Metallic Tubing
EP	-	Electric Pneumatic
EPDM	-	Ethylene Propylene Diene-Rubber
EPROM	-	Electrically Programmable Read Only Memory
ERW	-	Electric Resistance Welded
FACP	-	Fire Alarm Control Panel
FDA	-	Food and Drug Administration
F.E.	-	Flexible Elastomeric
FHC	-	Fume Hood Controller or Firehose Cabinet
F.L.A.	-	Full Load Amps
fpm	-	Feet per Minute
fps	-	Feet per Second
F.M.	-	Factory Mutual
ft.	-	Foot or Feet
ga	-	Gauge
gal	-	Gallons
GFD	-	Gallons per Square Feet per Day
G.P.D	-	Gallons per Day
G.P.H.	-	Gallons per Hour
GSS	-	Galvanized Sheet Steel
h-cu.ft.	-	Hour-cubic foot
HCFC	-	HydroChloroFlourocarbons
HEPA	-	High Efficiency Particulate Air
H.O.A.	-	Hand/Off/Auto
HOT	-	Hand Held Operator Terminal
H.S.S.	-	Hollow Steel Sections
HTK	-	Hood Termination Kit
hp	-	High Pressure or Motor Horsepower
hz	-	Hertz
I.A.O.	-	Insurance Advisory Organization of Canada
I.C.U.	-	Intensive Care Unit
(I.)G.P.H.	-	(Imperial) Gallons per Hour
(I.)G.P.M.	-	(Imperial) Gallons per Minute
in.	-	Inch or Inches
kg	-	Kilogram
kg/cu.m.	-	Kilogram per cubic meter
kPa	-	Kilopascals
KVA	-	Kilovolt-amps
kW	-	Kilowatts
lbs/cu.ft.	-	Pounds per cubic foot
lbs/hr.	-	Pounds per Hour
L	-	Litre
L/s	-	Litres per Second
LFC	-	Laminar Flow Cabinets
LEDs	-	Light Emitting Diode
LCP	-	Laboratory Control Panel
lin.ft.	-	Linear foot
lin.m.	-	Linear meter
ma	-	Milliamps
MAC	-	Make-up Air Controller
mADC	-	Milliamps Direct Circuit

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M.B.H.	-	1000 British Thermal Units per Hour
M.C.C.	-	Motor Control Centre
mm	-	Millimetre
m	-	Metre
m/s	-	Metres per Second
mL	-	Millilitre
MCP	-	Motor Control Panel
M.O.V.	-	Motor Over Voltage
mPa	-	Millipascals
MSC	-	Master Summing Controller
MSG	-	Manufacturers' Standard Gauge
N.B.S.	-	National Bureau of Standards
N.C.	-	Noise Criterion as Defined by Graph in A.S.H.R.A.E.
NCCLS	-	National Committee for Clinical Laboratory Standard
N.E.M.A.	-	National Electrical Manufacturer's Association
N.F.P.A.	-	National Fire Protection Association
NIM	-	Network Interface Module
NIST	-	National Institute of Standards and Technology
NIOSH	-	National Institute of Occupancy Safety and Health
NPS	-	American National Standard Straight Pipe Thread
N.P.S.H.	-	Net Positive Suction Head
NPT	-	American National Standard Taper Pipe Thread
No.	-	Number
OAT	-	Outside Air Temperature
O.B.C.	-	Ontario Building Code
OC	-	On Centre
OCP	-	Operator Control Panel
OPSS	-	Ontario Provincial Standard Specification
O.S. & Y.	-	Outside Screw and Yoke
O.W.R.A.	-	Ontario Water Resources Act
oz.	-	Ounce or Ounces
PCU	-	Personal Computer Unit
PE	-	Pneumatic Electric
PIT	-	Portable Interface Terminal
ph	-	Hydrogen Ion Concentration
ppm	-	Part per Million
psf	-	Pounds per Square Foot
psi	-	Pounds per Square Inch
psia	-	Pounds per Square Inch Absolute
psig	-	Pounds per Square Inch Gauge
PWM	-	Pulse Width Modulation
PVC	-	Polyvinyl Chloride
qt.	-	Quart
RAH	-	Return Air Humidity
Rh	-	Relative Humidity
rpm	-	Revolutions per Minute
RPU	-	Remote Processing Unit
RPU-TU	-	Remote Processing Unit for Terminal Units
SCR	-	Silicone Controlled Rectifier
SMACNA	-	Sheet Metal and Air Conditioning Contractors National Association
sp. in. wg.	-	Static Pressure, Inches Water Gauge
S.P.D.T.	-	Single Pull Double Throw
SPS	-	Sash Position Sensor
s.s	-	Stainless Steel
SF	-	Supply Fan

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SPS	-	Sash Position Sensor
SPWM	-	Sine-Coded Pulse Width Modulated
S.S.P.C.	-	Steel Structures Painting Council (The Society of Protective Coatings)
sq.m.	-	Square Meter
STC	-	Supply/Exhaust Tracking Controller
SWS	-	Sidewall Velocity Sensors
T.D.S.	-	Totally Dissolved Solids
TEFC	-	Totally Enclosed Fan Cooled
TIG	-	Tungsten Inert Gas
TKV-TWA	-	Threshold Limit Value – Time Weighted Average
UACU	-	Unitary Air Conditioning Units
U.L.	-	Underwriter's Laboratories
U.L.C.	-	Underwriter's Laboratories of Canada
um	-	Ohm
USP	-	United States Pharmacopoeial
U.S. gal.	-	United States Gallons
USGPH	-	United States Gallons per Hour
USGPM	-	United States Gallons per Minute
VAC	-	Volts Alternating Current
VACFH	-	Closed Loop Variable Frequency Drive
VDC	-	Volts Direct Current
VFD	-	Variable Frequency Drive
VSC	-	Variable Speed Controllers
VSD	-	Variable Speed Drives
W	-	Watt
W/cu.m.	-	Watts per Cubic Meter
W/ft.	-	Watts per Foot
W/m	-	Watts per Meter
W/sq.in.	-	Watts per Square Inch
W/sq.m.	-	Watts per Square Meter
WC	-	Water Closet
wb	-	Wet Bulb
wg	-	Water Gauge
WHMIS	-	Workplace Hazardous Material Information System
WSP	-	Working Steam Pressure
WOG	-	Water, Oil, Gas

END OF SECTION 21 05 01.00

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Conform to Section 21 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
2. Products
  - 2.1. NOT USED
3. Execution
  - 3.1. DOCUMENTATION REQUIREMENTS
    - 3.1.1. As the project progresses mark all changes and deviations from that shown on the drawings to the white prints.
    - 3.1.2. Keep drawings up-to-date during construction and in addition to field measurements include change orders, site instructions and all other changes. Drawings shall be available for review at all times.
    - 3.1.3. On completion of the work, forward to the Consultant the set of drawings indicating all such changes and deviations for review by the Consultant.
    - 3.1.4. After the drawings have been reviewed, transfer all as-built mark-ups from prints to the diskettes using latest release of AutoCAD software. Submit prints/plots of drawings after information has been transferred to diskette for review by the Consultant.
    - 3.1.5. Final as-built prints/plots shall not contain markings or corrections by hand (i.e. marker, pen, pencil, etc.). Drawings containing mark-ups shall be revised on computer and printed/plotted.
    - 3.1.6. The project will remain incomplete and a holdback will be retained until satisfactory as-built drawings and disks are provided.
    - 3.1.7. The Mechanical Contractor may request from the Consultant the most current mechanical drawings on AutoCAD, IBM PC CD ROM format (at a nominal charge of \$200.00).
    - 3.1.8. The AutoCAD documents shall meet all the Owner's and Consultant's requirements.
  - 3.2. CAD REQUIREMENTS
    - 3.2.1. Fonts for text shall be AutoCAD standard. Custom fonts, shape files, etc., are not to be used.
    - 3.2.2. Final as-built drawings shall be returned on CD ROM.
    - 3.2.3. Each CD ROM shall be clearly labelled with Consultant and Owner, Contract number, file names and Drawing number. If a complete listing exceeds the label size provide a "readme.txt" file in ASCII format with each CD ROM. A printed copy of the readme file shall accompany each CD ROM.
    - 3.2.4. All drawings shall be in the same units as issued on Bid Documents.
    - 3.2.5. Special effort shall be made to ensure that drafting is accurate: i.e. appropriate lines are indeed horizontal and vertical; lines that should intersect do but not over-intersect and ensure that entities are placed on correct layers.

END OF SECTION 21 05 02.00

1. General
    - 1.1. WORK INCLUDED
      - 1.1.1. Conform to Section 21 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
  2. Products
    - 2.1. SHOP DRAWINGS
      - 2.1.1. Shop Drawings shall be organized by Specification Section. Do not combine more than one section into one submission. Incorrect submissions will be returned without review.
      - 2.1.2. Shop Drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each Shop Drawings shall give the identifying number as noted in the documents of the specific pump, fan, etc. for which it was prepared.
      - 2.1.3. Each Shop Drawing for non-catalogue items shall be prepared specifically for this project. Shop Drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.
      - 2.1.4. When requested, Shop Drawings shall be supplemented by data explaining the theory of operation – for example: a variable speed motor control – the Consultant may also request that this information be added to the maintenance and operating manual.
      - 2.1.5. Provide a cover sheet with the project name, issue date, issue number, Specification section number, title of section and with space for Shop Drawing review stamps for the Contractor and Consultant.
  3. Execution
    - 3.1. SUBMISSIONS
      - 3.1.1. Each Shop Drawing or catalogue sheet shall be stamped and signed by the Contractor to indicate that he has checked the drawing for conformance with all requirements of the Drawings and Specifications, that he has co-ordinated this equipment with other equipment to which it is attached and/or connected and that he has verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the work of other trades. Ensure that electrical co-ordination is complete before submitting drawings for review.
      - 3.1.2. Installation of any equipment shall not start until after final review of Shop Drawings by the Consultant has been obtained.
      - 3.1.3. Provide all necessary copies required for the trades, suppliers or other Consultants.
- END OF SECTION 21 05 03.00

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Conform to Section 21 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
    - 1.1.2. Piping and equipment provided under the Mechanical Division shall be complete with all necessary supports and hangers required for a safe and workmanlike installation.
    - 1.1.3. Hangers, supports, anchors, guides, and restraints shall be selected to withstand all static and dynamic loading conditions which act upon the piping system and associated equipment. The Mechanical Division shall prepare detailed shop drawings showing all anchors and guides for all systems with the potential for thermal expansion/contraction and/or loads due to weight or thrust. The drawings shall bear the signed seal of a Professional Engineer licensed to practice in the appropriate discipline and place of work. The drawings shall include all details of construction, static and dynamic forces at points of attachment, etc. necessary for review and acceptance by the project Structural Consultant. Make adjustments as necessary to satisfy the requirements of the Structural Division. No anchor points shall be permitted without reviewed shop drawings and, where installed prior to review, shall be removed and replaced to the satisfaction of the Consultant.
    - 1.1.4. Where this Section indicates "Structural Consultant" it shall be understood to mean the "Landlord and/or the Landlord's Structural Consultant".
2. Products
  - 2.1. MATERIALS
    - 2.1.1. Provide hangers and supports manufactured by Anvil International or E. Myatt & Co.
    - 2.1.2. All pipe hangers and supports shall be manufactured to the latest requirements of MSS-SP-58. Where applicable, design and manufacture of hangers and supports shall also conform to ANSI/ASME Code for Pressure Piping B31.1.
    - 2.1.3. Roof supports for pipe or duct runs greater than 30 ft. shall be Thaler Roof Specialities.
    - 2.1.4. Roof supports for pipe or duct runs less than 30 ft. shall be Thaler Roof Specialities or Portable Pipe Hangers Inc.
    - 2.1.5. All hangers, supports, brackets and other devices installed exterior to the building shall be galvanized to prevent failure from environmental corrosion. If galvanized components cannot be used submit samples of proposed substitute for review prior to installation.
3. Execution
  - 3.1. INSTALLATION
    - 3.1.1. Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow free expansion and contraction of the piping, and prevent undue stress to building structural components.
    - 3.1.2. Piping shall be supported from walls, beams, columns, and slabs using approved structural attachments. In situations where approved attachments cannot be used, alternative attachments or substructure assemblies shall receive approval prior to installation. Prior

approval shall be given for any cutting or drilling of building structural steel. Damage or modification to the structure through welding, cutting, or drilling shall not be permitted if it reduces the integrity of the building structure as deemed by the Structural Consultant. It shall be the responsibility of the Mechanical Division to supply anchor bolts and base diagrams for equipment and pipe supports showing exact location of attachments.

- 3.1.3. All drilling for hangers, rod inserts and work of similar nature shall be done by this Division.
- 3.1.4. Auxiliary structural members shall be provided under the Mechanical Section concerned where piping, ducts or equipment must be suspended between the joists or beams of the structure, or where required to replace individual hanger to allow for installation on new services. Auxiliary structural members shall be the same material and finish as the primary structure (i.e. prime painted, galvanized, etc.). Submit details for review as requested.
- 3.1.5. Depending on the type of structure, hangers shall be either clamped to steel beams or joists, or attached to approved concrete inserts. Submit proposed hanger details for review and acceptance by the Structural Consultant. Make adjustments as necessary to satisfy the requirements of the Structural Division.
- 3.1.6. Suspension from metal deck shall not be allowed unless specifically accepted by the Consultant. Drawings of the proposed method of suspension must be submitted for review.
- 3.1.7. Hangers, hanger rods and inserts in all parking and ramp areas shall meet the requirements of CAN/CSA-S413-94 (R2005) and shall be of corrosion-resistant material or have an effective, durable corrosion resistant coating. Submit samples for approval.
- 3.1.8. Hanger rods shall be subject to tensile loading only. Suspended piping shall be supported by adjustable hanger rods sized as follows:
- | Pipe Size                         | Hanger Rod Diameter |
|-----------------------------------|---------------------|
| 50mm (2 in.) and under            | 9mm (3/8 in.)       |
| 65mm (2-1/2 in.) and 75mm (3 in.) | 12mm (1/2 in.)      |
- 3.1.9. Unless otherwise specified or shown hanger spacing for all services shall be as follows:
- | Nominal Pipe Diameter             | Maximum Span  |
|-----------------------------------|---------------|
| Up to and including 25mm (1 in.)  | 2.1 m (7 ft.) |
| 32mm (1-1/4 in.) to 125mm (5 in.) | 3 m (10 ft.)  |
- In addition, provide a hanger within 600mm (2 ft.) on each side of valves on pipes over 38mm (1½ in.) diameter, elbows or tees.
- 3.1.10. Hanger spacing for plumbing and drainage services shall be in accordance with the plumbing code.
- 3.1.11. Hanger spacing for fire protection services shall be in accordance with the N.F.P.A. codes.
- 3.1.12. All horizontal piping 50mm (2 in.) diameter and larger shall be supported by adjustable wrought iron clevis type hangers. Smaller piping shall be supported by adjustable split ring hangers or clevis type hangers.
- 3.1.13. Suspending one hanger from another shall not be permitted.
- 3.1.14. For cold water services such as domestic cold water, chilled water pipe on dual chilled and hot water pipe 25mm (1 in.) and smaller, install a section of high density insulation complete with continuous vapour barrier between the pipe and the hanger. Refer to Section 15250 – MECHANICAL INSULATION.
- 3.1.15. For cold water services such as domestic cold water, chilled water pipe or dual chilled and hot water pipe larger than 25mm (1 in.), use a galvanized steel shield between the insulation and the hanger. Between the shield and the pipe, install a section of high density insulation



complete with continuous vapour barrier. Refer to Section 15250 – MECHANICAL INSULATION.

The shield width shall be minimum 1/4 of the pipe circumference. The length and gauge shall be as follows:

- .1 150mm (6 in.) long and 14 US gauge for pipe larger than 25mm (1in.) up to 50mm (2 in.) diameter
- .2 250mm (10 in.) long and 12 US gauge for pipes 65mm (2-1/2 in.) to 300mm (12 in.) diameter
- .3 300mm (12 in.) long and 10 US gauge for pipes 350mm (14 in.) to 400mm (16 in.) diameter

- 3.1.16. Hangers and riser clamps in contact with copper pipe shall be copper coated construction or plastic coated. Taped hangers and riser clamps shall not be accepted.
- 3.1.17. Provide constant support hangers where shown for horizontal or vertical pipes which require vertical movement for expansion. Vertical movement shown for these hangers shall be movement either up or down. Provide hangers to allow for movement in both directions.
- 3.1.18. Unless otherwise specified or shown, vertical pipes shall be supported at least every fourth floor or every 12 m (40 ft.) maximum.
- 3.1.19. Pipe slides shall be pre-engineered type. Structural or fabricated tees shall be welded to the pipe or to the protection saddle as shown.
- 3.1.20. Install resilient hangers in accordance with Section 15200 – VIBRATION AND NOISE CONTROL.
- 3.1.21. Install additional seismic supports in accordance with Section 15225 – SEISMIC RESTRAINT SYSTEMS.
- 3.1.22. Other means of support shall be as shown or as specified hereunder.
- 3.1.23. For special equipment supports refer to equipment sections. Where no support method is identified secure wall mounted equipment to metal framing or masonry, with steel toggle or expansion fasteners, machine screws or sheet metal screws as applicable. Plastic, fibre or soft metal inserts shall not be acceptable. Wall mounted equipment shall not exceed 45.5 Kg (100 lbs) in weight or 250mm (10") in depth unless reviewed or detailed by the Consultant. Where framing does not permit direct attachment, provide metal strut sub-framing or minimum 19mm (3/4 in.) fire retardant treated plywood backboards, unpainted, attached to the framing. Provide attachments for backboards at 600mm (24 in.) on centres with no less than 4 attachments.

END OF SECTION 21 05 29.00

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Conform to Section 21 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
    - 1.1.2. Include for all cutting and patching for all mechanical services
    - 1.1.3. Where this Section indicates “Structural Consultant” it shall be understood to mean the “Landlord and/or the Landlord’s Structural Consultant”.
2. Products
  - 2.1. MATERIALS
    - 2.1.1. All services and materials used for the cutting and patching shall be carried out by professional workers experienced in the cutting and patching work to be done.
3. Execution
  - 3.1. INSTALLATION
    - 3.1.1. Locate all openings in non structural elements requiring cutting and patching in a timely manner to avoid unnecessary cutting. All openings shall be shown on Drawings and submitted to the Consultant for review. No holes through structure shall be permitted prior to review by the Structural Consultant.
    - 3.1.2. Locate existing mechanical and electrical services in walls and below the floor slab in all areas requiring core drilling and cutting. Core drilling for individual services shall be by this Division. Cut all openings no larger than is required for the services.
    - 3.1.3. Locate all openings in structure elements requiring cutting and patching and x-ray the structure to obtain Structural Consultant’s approval prior to cutting or core drilling of existing structure. Make adjustments to location of openings as required to minimize cutting of rebar and completely avoid electrical conduit.
      - .1 Cut holes through slabs only.
      - .2 Do not cut holes through beams.
      - .3 Holes to be cut are 200 mm (8 in.) (diameter) or smaller only.
      - .4 Maintain at least 100 mm (4 in.) clear from all beam faces. Space at least 3 hole diameters on Centre.
      - .5 For holes that are required closer than 25% of slab span from the supporting beam face, use cover meter above the slab to clear slab top bars.
      - .6 For holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars.
      - .7 X-rays shall be performed by a qualified technician, in a safe manner and in accordance with all applicable regulations governing this activity.
    - 3.1.4. Cutting and drilling shall only be at locations and times allowed by the Structural Consultant. Obtain written approval by the Structural Consultant prior to core drilling holes or openings. Protect all tenant areas where core drilling occurs.

- 3.1.5. Patch all openings after services have been installed to match the surrounding finishes.  
END OF SECTION 21 05 88.00

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Conform to Section 21 05 00.00 - GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
    - 1.1.2. Provide shop drawings with technical data on all types of insulation to be installed.
    - 1.1.3. Provide samples of each type of insulation indicating where each is to be used and a sample of a typical vapour barrier dam. Samples shall be mounted on boards and shall be kept at the Contractor's site office.
2. Products
  - 2.1. MATERIALS
    - 2.1.1. Fibreglass insulation shall be Owens-Corning, Certainteed, Manson, Johns Manville, Knauf or Fibrex.
      - .1 Duct insulation shall be rigid board vapour seal 48 kg/cu.m. (3 lbs/cu.ft.) density duct insulation with factory applied vapour barrier. Flexible duct insulation shall be 24 kg/cu.m. (1-1/2 lbs/cu.ft.) type with vapour barrier.
      - .2 Pipe insulation shall be preformed sectional fibreglass or mineral fibre insulation with factory applied all service jacket.
    - 2.1.2. Flexible elastomeric insulation for ducts exterior to the building shall be Armacell with Tuffcoat 25 surface or Nomaco K-Flex with R-374 protective coating.
    - 2.1.3. Extruded polystyrene insulation for ducts exterior to the building shall be Dow Weathermate Styrofoam insulation board.
    - 2.1.4. Mineral Fibre Board Thermal insulation for ducts exterior to the building shall be Roxul RXL 80 125 kg/cu.m. (8 lbs/cu.ft.) density board insulation with factory applied reinforced foil vapour barrier.
    - 2.1.5. Foamglass insulation shall be Pittsburgh-Corning.
    - 2.1.6. Flexible elastomeric insulation shall be Armacell or Nomaco with adhesive applied to both surfaces to be joined. Flexible elastomeric insulation shall not be used on pipes that are electrically traced.
    - 2.1.7. Insulation jacket for services and ductwork exterior to the building, and for indoor components such as valves, pump, meters, etc. shall be Childers or Armacell field applied U.V. protected mesh reinforced mastic.
      - .1 Mastic shall be equal to Childers VI-CRYL CP-10/11 weather barrier coating. Finish shall be white.
      - .2 Sealant for areas where mastic meets adjoining insulated or uninsulated surfaces or dissimilar weather proofing materials shall be equal to Childers CP-76.
      - .3 Glass fibre reinforcing mesh for thickness control and strength at joint interfaces in field applied mastic on exterior ductwork insulation shall be equal to Childers CHIL-GLAS # 10.
    - 2.1.8. Vapour barrier dam shall be Chil-perm CP30 with fibreglass cloth reinforcing.
    - 2.1.9. All cements and adhesives shall be as recommended by the manufacturer of the insulation. Insulation, insulation jacket, canvas and adhesive shall be fire retardant with a flame spread

- rating not to exceed 25 and a smoke developed rating not to exceed 50 when tested in accordance with CAN/ULC-S102-M.
- 2.1.10. P.V.C. fitted jackets and covers shall have a flame spread rating not to exceed 25 and a smoke developed rating not to exceed 50 when tested in accordance with CAN/ULC-S102-M.
- 2.1.11. Aluminum Jacket shall be 0.51mm (24 B&S Gauge - 0.0201 in) this sheet, embossed finish, with longitudinal slip joints and 50mm (2 in.) laps, die shaped fitting covers with factory applied moisture barrier.
3. Execution
- 3.1. INSTALLATION
- 3.1.1. Install insulation in accordance with the manufacturer's printed installation instructions unless noted otherwise.
- 3.1.2. Insulation thicknesses and conductivities shall meet or exceed the minimum standards set out in ASHRAE 90.1 (refer to Table 1 following) and as specified herein for the services covered.
- 3.1.3. Apply insulation to clean, dry surfaces only while ambient temperature is at least 10 deg. C. (50 deg. F.).
- 3.1.4. Commence application of insulation following required testing of piping, ductwork, and apparatus where such items are to be covered.
- 3.1.5. Recover all insulation, where exposed to view and not concealed in ceiling spaces or pipe spaces with 6 oz. canvas pasted on. Apply two coats of fire retardant lagging finish.
- 3.1.6. Where approved by the Consultant, as an alternative to the above, recover all piping insulation with a PVC jacket and preformed PVC elbows and fittings sealed with adhesive. PVC shall not be used on steam, medium and high temperature hot water piping or piping services that will be painted.
- 3.1.7. Cover all piping insulation external to the building and where specifically shown with field applied mesh reinforced mastic.
- 3.1.8. Where vapour barrier dams are called for, terminate the insulation and seal the vapour barrier to the pipe or ductwork using a mesh embedded in a vapour barrier mastic. Provide dams at valves, fittings used for servicing, groups of other types of fittings, irregular shaped objects at floor and wall penetrations, and at 15 m (50 ft.) intervals of straight pipe or straight ductwork for the following services: water piping that is less than 80 deg. F., including but not limited to the following:
- .1 Domestic cold water piping
  - .2 and exterior ductwork
- 3.1.9. Terminate insulation on pipes passing through fire rated walls or floors, and fit tight to the fire stop material.
- 3.1.10. Irregular shaped objects such as strainers, pipe system filters, cyclone separators, blowdown valves and other accessories requiring servicing, on insulated piping, shall be insulated with removable caps or sections. All edges shall be sealed between pipe and vapour barrier and held in place with stainless steel straps. Finish all insulation smooth, making the outline of pipe insulation a true circular and concentric shape. Shape the outline of fitted insulation to blend with adjacent covering.
- 3.1.11. On piping systems specified to be insulated, include insulation on valves, flanges, couplings and unions.
- 3.1.12. Do not use staples to secure joints of insulation jackets.

- 3.1.13. Apply bands to concealed pipe insulation on max. 600 mm (24 in.) centres.
- 3.1.14. Cold Services
- .1 For domestic cold water piping less than 75 mm (3 in.) where hangers on cold water lines penetrate vapour barrier make sure the penetration is properly sealed with insulation and vapour barrier continued up hanger a further 75 mm (3 in.).
  - .2 Apply 12 mm (1/2 in.) thick, preformed glass fibre pipe insulation with vapour barrier jacket or 12 mm (1/2 in.) thick flexible elastomeric insulation to all domestic cold water and chilled drinking water piping. Insulate the first 4500 mm (15 ft.) of the standpipe and/or sprinkler main.
  - .3 On cold water service valves, water meters, drain valves, vent connections, thermometer wells, pressure gauges and other irregular shaped objects, apply flexible elastomeric sheet insulation, thickness to suit service, cut and mitre as necessary, and attach with adhesive and stainless steel banding. Bond and seal edges of insulation to the adjacent surfaces and finish with field applied mesh reinforced mastic.
  - .4 Apply 50 mm (2 in.) thick rigid glass fibre insulation tank wrap by wiring or banding onto all chilled water storage tanks. Apply vapour barrier of foil faced flame resistant Kraft paper or aluminum foil, and recover with canvas. Apply insulation to legs/supports. Provide removable sections at access doors/manholes and all components requiring servicing. As an alternative to the above, provide 50 mm (2 in.) thick Flexible elastomeric sheet insulation.
  - .5 Insulate refrigerant suction lines with 12 mm (1/2 in.) flexible elastomeric insulation. Cover exterior piping with field applied mesh reinforced mastic.
- 3.1.15. Drainage Piping
- .1 Cover cast iron bell and spigot drainage pipe 75 mm (3 in.) and smaller with 12 mm (1/2 in.) preformed glass fibre pipe insulation, and finish with vapour barrier jacket. Cover the bell and spigot joint with a 12 mm (1/2 in.) thick flexible elastomeric insulation band that overlaps the fibreglass insulation 300 mm (12 in.) beyond joint in each direction. Seal band to the fibreglass insulation. Apply 25 mm (1 in.) thick insulation for all larger pipes.
  - .2 Sanitary drainage piping to be insulated:
    - .1 All piping passing through high humidity area
- 3.1.16. Ductwork and Equipment
- .1 Butt join insulation and attach with pins and speed washers, one per 0.186 sq.m. (2 sq.ft.), but not more than 450 mm (18 in.) apart in any direction. Apply fire resistive adhesive in 100 mm (4 in.) wide strips on 300 mm (12 in.) centres. Seal all joints with adhesive and apply vapour barrier tape. Install pins of suitable length for the thickness of insulation and clip flush after final installation of washers. Tack weld pins to sheet metal.
  - .2 On exposed insulation in mechanical rooms, increase thickness as necessary to give 12 mm (1/2 in.) thickness over flanges and angles. Provide corner beads to protect corners to a height of 2135 mm (84 in.) above floor and provide channels at floor line to finish off insulation on apparatus.
- 3.1.17. The following ductwork and equipment shall be insulated:
- .1 Outside and mixed air plenums
  - .2 Outside and mixed air ductwork, including ducts to and from independent ERVs
  - .3 Heating and cooling coil sections of ductwork and plenums
  - .4 Casings of supply fans in equipment rooms
  - .5 Supply ductwork in equipment rooms.

- .6 Exhaust and relief air ductwork. Plenums and/or casings from 1500 mm (60 in.) upstream of shut-off dampers to connection to exterior wall or roof
  - .7 Exhaust, relief and supply and return air ductwork, plenums and/or casings through non-air conditioned or unheated internal space. Use 50 mm (2 in.) thickness.
  - .8 For non-LEED projects, all supply ductwork from fans to take-off for VAV box for variable volume systems and all supply ductwork on constant volume systems.
- 3.1.18. Apply 2 layers of 50mm (2 in.) flexible elastomeric insulation on all ductwork which is external to the building. Exterior insulation shall be coated with factory applied coating. Provide sloped extruded polystyrene insulation support on top of ductwork to maintain slope at a minimum of 5%. All flanges shall be covered by a minimum of 12mm (1/2 in.).
- 3.1.19. As an alternative to the above, apply 2 layers of 50 mm (2 in.) thick rigid extruded polystyrene board insulation. Insulation on top of ductwork shall slope a minimum of 5% and all flanges shall be covered by a minimum of 12mm (1/2 in.). Install field applied mesh reinforced mastic jacket on all insulated ductwork which is external to the building in accordance with the manufacturers recommended installation. The mastic shall be trowelled, sprayed, or wet brushed to a smooth even finish. There shall be no voids or holidays.
- 3.1.20. TABLE 1: MINIMUM PIPE INSULATION THICKNESS/PERFORMANCE (BASED ON ASHRAE 90.1 AND MODEL NATIONAL ENERGY CODE FOR BUILDINGS)

Minimum Pipe Insulation – mm (in.)

Fluid Design Operating Temp. range deg. C. (deg. F.)	Insulation Conductivity Conductivity [W(m-K)] [h-cu.ft. – deg. F. (Btu-in.)]	Mean Rating Temp deg. C. (deg. F.)	Nominal Pipe Diameter – mm (in.) Runouts Up to 50 (2)	25 (1) and less	32-50 (1-1/4 to 2)	65-100 (2-1/2 to 4)	125- 150 (5- 6)	200 (8) and up
Heating Systems (Heating Glycol and Heating Water)								
(141-200)		(125)	(1.0)	(1.0)	(1.0)	(1.5)	(1.5)	(1.5)
41-60		38	25	25	25	25	38	38
(105-140)		(100)	(1.0)	(1.0)	(1.0)	(1.0)	(1.5)	(1.5)
Domestic and Service Hot Water Systems <sup>c</sup>								
41 and greater	0.040	38	25	25	25	38	38	38
(105) and greater	(0.28)	(100)	(1.0)	(1.0)	(1.0)	(1.5)	(1.5)	(1.5)
Cooling Systems (Chilled Water, Chilled Glycol, Brine and Refrigerant)								
5-13	0.039	24	25	25	25	25	25	25
(40-60)	(0.27)	(75)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)
Below 4.4	0.039	24	25	25	38	38	38	38
Below (40)	(0.27)	(75)	(1.0)	(1.0)	(1.5)	(1.5)	(1.5)	(1.5)

Piping installed exterior to the building shall meet the minimum insulation requirements of Heating Systems with a fluid design operating temperature above 177 Deg. C. (350 Deg. F.).

<sup>b</sup> Runouts to individual terminal units not exceeding 3.7 m (12 ft.) in length

<sup>c</sup> Applies to recirculating sections of service or domestic hot water systems and first 2.4 m (8 ft.) from storage tank for non-recirculating systems.

END OF SECTION 21 07 00.00

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 21 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

2. Execution

2.1. INSTALLATION

2.1.1. Cleanouts shall be installed in horizontal drains at each change of direction and as required.

END OF SECTION 22 05 76.00



1. General
- 1.1. WORK INCLUDED
- 1.1.1. Conform to Section 21 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
2. Products
- 2.1. MATERIALS
- 2.1.1. Pipes and fittings shall be in accordance with the following unless specified otherwise by local authorities.
- 2.1.2. All city and domestic water, above grade, 75 mm (3 in.) and smaller, less than 1380 kPa (200 psi) working pressure:
  - .1 Pipe: Copper Tubing, Type “L”, Hard Drawn, ASTM B88. Fittings: wrought copper solder joint pressure fittings, ANSI/ASME B16.22 or cast copper alloy solder joint pressure fittings, ANSI/ASME B16.18.
  - .2 Joints made with 95-5 tin antimony, 96-6 tin silver, or 96-4 tin silver solder, ASTM B32.
  - .3 Couplings to be designed with angle bolt pads to provide a rigid joint.
    - .1 Installation ready for direct stab installation without field disassembly, complete with grade EHP gasket, rated for -35 deg. C. to 121 deg. C. (-30 deg. F. to 250 deg. F. Victaulic 607.
    - .2 Copper tubing standard coupling complete with EPDM flush seal gaskets rated for -35 deg. C. to 110 deg. C. (-30 deg. F. to 230 deg. F.) Victaulic 606.
  - .4 Gate valves, 860 kPa (125 psi) WSP or 1380 kPa (200 psi) non-shock WOG with bronze body, rising stem screwed. Crane #428, Jenkins #810J, Toyo 293 or Kitz 24, for threaded ends or Crane #1334, Jenkins #813J, Toyo 299 or Kitz 44 for solder ends.
  - .5 All city and domestic water below grade 50 mm (2 in.) and smaller:
  - .6 Soft copper Type K conforming to ASTM B88-83.
  - .7 Minimum number of joints using 95-5 tin-antimony or tin-silver solder.
  - .8 Gate valves, bronze body, non-rising stem, extension sleeve and box to grade, to local authorities approval.
- 2.1.3. All city and domestic water below grade 65 mm (2-1/2 in.) and larger:
  - .1 Copper pipes Type L with wrought or cast couplings and fittings conforming to ASTM B88-83 etc.
  - .2 Joints made with silver solder.
  - .3 Alternate for buried pipe; cast or ductile iron.
  - .4 Gate valves, AWWA iron body, non-rising stem, extension sleeve and box to grade, to local authorities approval.

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- 2.1.4. Storm and sanitary drains and vents above grade shall be cast iron or copper pipe installed as in regulations, except where copper pipe is used, joints to be made with 95-5 solder. ABS and PVC pipes are not acceptable.
- 2.1.5. Gate valves in sanitary drains shall be equal to Seguro rubber sealed, cast iron, Class 150, ASA B16.10, with ASA B16.1 flanged ends, with OS&Y rising stem operation.
- 2.1.6. Execution
- 2.2. INSTALLATION
- 2.2.1. Valves shall be provide as shown and as required for the satisfactory operation and control of all equipment and shall be installed to enable each piece of equipment to be isolated.
- 2.2.2. Gate valves shall be installed at the base of each riser and at each branch take-off. Where the equipment is to be isolated within easy view of and not more than 6000 mm (20 ft.) from the main, at the branch take-off, then the branch take-off valve may serve as the equipment isolating valve.
- 2.2.3. Drain valves shall be installed at each low point in the piping systems and at each tank.
- 2.2.4. Check valves shall be installed as shown and where required to prevent backflow.
- 2.2.5. Connections between copper and steel pipe shall be made with brass or bronze fittings where other type of connection is not specified in regulations.
- 2.2.6. All piping shall run parallel with closest wall.
- 2.2.7. Piping in walk-in pipe spaces shall be installed as close to one wall as possible.
- 2.2.8. Slope all drains and vents in accordance with the plumbing code but not less than the minimum slopes shown on the drawings. Slope all water lines 25 mm in 12 m (1 in. in 40 ft.) unless shown otherwise.

END OF SECTION 22 11 13.00

- 1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Conform to Section 21 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
  - 1.2. QUALITY ASSURANCE
    - 1.2.1. Acceptable balancing companies are limited to the following and shall be approved by the Owner:
      - .1 Design Test
      - .2 Pro-Air Testing
      - .3 VPG Associates
      - .4 Test & Air Balance
      - .5 Dynamic Flow Balancing Ltd.
- 2. Products
  - 2.1. NOT USED
- 3. Execution
  - 3.1. EXISTING SYSTEM VERIFICATION
    - 3.1.1. Prior to commencement of any work, check and verify on site, the total supply air quantity and available static pressure presently available from the main supply air ducts and/or the fan serving the project area and report the test results to the Consultant.
  - 3.2. SYSTEM BALANCING
    - 3.2.1. Balance the complete air system including air volumes and control settings under maximum system pressure drop conditions (filter at replacement condition). Test the entire system for noise, tightness of joints and proper functioning of the system. Make noise tests under minimum system pressure drop conditions (highest air velocities and clean filter conditions). Make necessary alterations and repeat the tests until satisfactory operation is achieved.
    - 3.2.2. The Independent Balancing Company measures and reports upon the air volume at each diffuser, register and grille. Report shall also show the final balance position on all noted balancing dampers after final adjustment of air turning and balancing devices. Provide a deficiency report to the Contractor prior to finalizing the testing and balancing report to the Consultant, with all noted deficiencies resolved. Submit three (3) copies of the final air systems test and balance report to the Consultant. Indicate all test results including coil

entering and leaving air temperature, closest and furthest outlet supply air temperatures, and room temperatures for all air systems.

- 3.2.3. Provide assistance to the air balancing company and shall provide control settings, new filters, and other incidentals and equipment required for the measurements.
- 3.2.4. Air volumes measured by the balancing company shall be within plus or minus 5% of those shown on Drawings for diffusers, grilles and registers and within 10% for fans.
- 3.2.5. Adjust all deflection blades on new and existing supply air grilles and diffusers, to ensure that air pattern is horizontal across the ceiling.
- 3.2.6. Include for one additional day (8 hours) of fine tuning as may be required to accommodate tenant specified requirements. This final adjustment may be required any time within the first six months of occupancy.
- 3.2.7. In all cases where measurements by the balancing company show failure to comply with the Drawings and Specifications, engage the balancing company to rebalance the system at no increase to Contract price.
- 3.2.8. The balancing of the air and water systems shall be performed by the same balancing company.

END OF SECTION 23 05 93.26

1. General
- 1.1. WORK INCLUDED
- 1.1.1. Provide all labour, materials, products, equipment and services to supply, install, test and commission building automation system (BAS) with direct digital control (DDC) for building mechanical and electrical systems and interface with other microprocessor based building subsystems as indicated on drawings and described herein.
- 1.2. SYSTEM OUTLINE:
  - 1.2.1. The documentation contained in this section and other contract documents pertaining to building automation system (BAS) is schematic in nature. The contractor shall provide all required hardware and software necessary to implement the functions shown or implied in the contract documents. Connect new BAS to the existing base building BAS. System architecture to be modular permitting expansion of application software, system peripherals and field hardware. Each controller to operate independently by performing its own specified control, alarm management, operator i/o and historical data collection receiving information from input field devices and controlling output field devices to perform the control sequences. DDC controller may control more than one system provided that points associated with those systems are connected to that same controller. DDC controllers to be configured so that main inputs and outputs from any control loop are located in that same controller. Global points used for control loop reset such as outdoor air temperature are exempt from this requirement. DDC controllers to be capable of operating with local closed loop programming, independent from the server if communication is interrupted. Where PID control loops are called for in the sequences, they are to be implemented within the controller.
- 1.3. OPEN PROTOCOL STANDARD
  - 1.3.1. Intention of this specification is to provide an integrated, open protocol BAS, either BACNet as defined by ANSI/ASHRAE standard 135-2008 or LONWorks as defined by ANSI/CEA standard 709.1.
- 1.4. EQUIPMENT SUPPLIED FOR INSTALLATION UNDER OTHER SECTIONS
  - 1.4.1. Automatic control valves except otherwise noted, temperature sensor wells, motorized dampers except otherwise noted. Verify damper sizes and connection type with sheet metal contractor prior to ordering.
- 1.5. SUBMITTALS
  - 1.5.1. Before start of construction, submit completely engineered and coordinated shop drawing package with all control diagrams, points lists, valve, damper, room and room temperature sensors schedules and all equipment data sheets.

2. Products

2.1. NETWORK

- 2.1.1. BAS network shall have an extra 25% capacity for future expansion on all tiers. Remote network access: provide access to the LAN from a remote location, via the internet. The owner shall provide a connection to the Internet.

2.2. CENTRAL SERVER / WORKSTATION:

- 2.2.1. Provide industry standard hardware that meets or exceeds DDC system manufacturer recommended specifications.

2.3. OPERATOR INTERFACE:

- 2.3.1. Completely web based without the need for interface/translation devices or need to load software individually on each computer. The primary point of interface to be a standard web browser such as Microsoft Internet Explorer. The operator interface is to provide complete tool sets, operational features, multi-screen displays and other necessary features to comply with this specification. System and software to permit multiple user remote access via the internet.

2.4. POWER SUPPLIES

- 2.4.1. Provide a separate power supply for every controller with the exception of application specific controllers.

2.5. CONTROL DEVICES

- 2.5.1. Motorized Control Dampers: Dimensions as indicated. Parallel blade dampers shall be used for two position control. Opposed blade dampers shall be used for modulating control.
- 2.5.2. Actuators for Dampers, Electronic: floating control signal is acceptable only for VAV damper application. Angle of rotation adjustable between 0° to 90°. Stall protection mechanical or electronic. Actuators shall have electronic overload protection or digital rotation sensing circuitry to prevent actuator damage throughout the entire rotation. Non-spring return for VAV terminals; spring return for other applications.
- 2.5.3. Control Valves: Characteristics, materials and pressure ratings suitable for the application; refer to schedules. Flow Characteristic: water, two-way equal percentage, three-way A port equal percentage, B port linear or modified linear; steam, linear. Sizing Water Valves: two-position, line size with full ports. Two-way Modulating: non radiation, pressure drop equal to the pressure drop through the coil or 27 kPa (4 psi), whichever is greater. Radiation, pressure drop equal to 7 kPa (1 psi). Three-way modulating: non radiation, pressure drop equal to the pressure drop through the coil or 27 kPa (4 psi), whichever is greater. Radiation, pressure drop equal to 7 kPa (1 psi). Sizing Steam Valves: two-position pressure drop equal to 10% to 20% of inlet pressure. Modulating: pressure drop equal to 50% of inlet pressure.
- 2.5.4. Actuators for Control Valves, Electronic: floating control signal is not acceptable. Failsafe: non-spring return for radiation and terminal reheat coils; spring return for others. Spring returns to normal position within 15 seconds. Close-off Pressure: Water, two-way, 150% of total system head, three-way: 300% of the pressure differential between ports A and B at design flow, or 100% of total system head. Steam: 150% of inlet pressure.

- 2.5.5. Digital Thermostat: 7-day programmable digital type suited for the application, user selectable engineering units (F or C) and set point adjustment, support automatic daylight savings time switchover and automatic heat/cool changeover when applicable.
- 2.5.6. Temperature Sensors: resistance type, two-wire 1000 ohm nickel RTD, two-wire 1000 ohm platinum RTD or two-wire 10,000 ohm thermistor.
- 2.5.7. Relative Humidity Sensors: calibrated to NIST standards, range 0 to 100% RH and accuracy +/- 2 % of output reading.
- 2.5.8. CO2 Sensors: sensor shall employ non-dispersive infrared technology (NDIR), accuracy shall be +/- 75 ppm over 0-1500 ppm range.
- 3. Execution
  - 3.1. GENERAL WORKMANSHIP
    - 3.1.1. Install all controllers, cabinets, control devices and power supplies in readily accessible locations providing adequate ambient conditions for its specified application and to the Canadian electrical code. Install products to manufacturer's installation instructions. Install parallel to building walls and floors unless indicated or specified or required otherwise by manufacturer's installation instructions. Mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
  - 3.2. EXISTING PRODUCTS
    - 3.2.1. Apply reused existing products to the same requirements for new products. During construction check and verify reused existing products are operational. For existing product that is not operational submit a proposal to replace existing product for approval by the consultant.
  - 3.3. WIRING AND CONDUIT
    - 3.3.1. Wire shall be neatly tie wrapped to conduit mounted to the building structure but must be installed at right angles or parallel to the building. Loose wiring shall only be allowed over a distance of 1500 mm (5 ft.), but must not pass over lighting fixtures. Wiring in equipment room, between floors, or between concrete walls shall be installed in conduit. Exposed wiring will not be accepted. Conduit shall be installed at right angles or parallel to the building walls.
  - 3.4. POWER WIRING
    - 3.4.1. Power for building automation system (BAS) shall be provided under electrical division at 120 VAC 60 Hz single phase and shall terminate in junction boxes installed where shown on electrical and mechanical drawings. Wiring and conduit from these boxes to control devices being electrically powered to be provided by building automation system (BAS) contractor.
  - 3.5. COMMUNICATION WIRING
    - 3.5.1. Install communication wiring per controls manufacturer recommendations as to type of wire used and segment lengths.

3.6. IDENTIFICATION

- 3.6.1. All wires shall be tagged at both ends. The tagging shall identify the device it is connected to. Use of the point object name is acceptable. Label wires, control devices, controllers.

3.7. TESTING AND COMMISSIONING

- 3.7.1. Test and commission the BAS prior to the Demonstration. Prepare test forms which shall identify each test. The forms shall be sub-divided into points, controllers, programs, loops, networks and graphics.

3.8. DEMONSTRATION

- 3.8.1. When all tests have been completed and the documentation completed, request a meeting with the Consultant and Owner. Provide at this meeting a demonstration that all systems on the BAS are operating.

3.9. INSTRUCTION AND TRAINING

- 3.9.1. Provide one day of instruction that shall cover the operation and maintenance of the BAS.

END OF SECTION 23 09 00.00



1. General

1.1. WORK INCLUDED

- 1.1.1. The locations of all sensors shall be discussed with and approved by the owner and/or consultant, before installation. Locations shown are approximate only, and are given to assist the contractor in pricing only, and shall not be construed as being the final approved location.
- 1.1.2. The control sequence descriptions and point schedules are complementary, provide all points required.
- 1.1.3. All settings and set points listed in this section shall be operator adjustable. Provide a specific set of programs to achieve automated, operator independent control of facility sub-systems.

2. Products

2.1. GENERAL APPLICATION PROGRAMS

- 2.1.1. Provide a specific set of programs to achieve automated, operator independent control of facility sub-systems.

3. Execution

3.1. XXX

3.1.1. xxx

END OF SECTION 15951

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Conform to Section 21 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
2. Products
  - 2.1. MATERIALS
    - 2.1.1. Defrost timers shall be Paragon, Eagle or other approved manufacturer.
    - 2.1.2. Refrigerant valves shall be Henry or Superior valve. Charging valve shall have removable seal cap, chained to valve.
    - 2.1.3. Refrigerant lines shall be Type L copper tubing. Fittings shall be wrought copper. Brazing shall be done with Sil-Fos or Easy-Flo.
    - 2.1.4. Electric room thermostats shall be White-Rogers, Penn, Honeywell or other approved manufacturer.
    - 2.1.5. All suction lines shall be insulated with 12 mm (1/2 in.) thick flexible elastomeric insulation, Armaflex II or Imcoshield.
3. Execution
  - 3.1. INSTALLATION
    - 3.1.1. Install fittings in the liquid line from the condensing unit to the evaporator in the following order:
      - .1 Charging valve
      - .2 Strainer-Drier
      - .3 Sight Glass
      - .4 Shut-off Valve
      - .5 Solenoid Valve
      - .6 Thermostatic Valve
    - 3.1.2. After assembly, evacuate each refrigerant system, test and charge using the following procedure. Any further steps required to ensure warranty of the refrigeration equipment shall also be done.
    - 3.1.3. Evacuate each refrigerant system with a vacuum pump to 1.7 kPa (0.5 in.) of mercury absolute. The system shall maintain this vacuum with the vacuum pump stopped for one hour. The system shall then be charged with refrigerant to 105 kPa (15 psi) followed with an

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oil pumped nitrogen charge to 150% of the operating pressure of the refrigerant being used. Test the complete system with a Halide or similar acceptable leak detector. If there are any leaks, repair with Sil-Fos or Easy-Flo and repeat the test. Following this, evacuate the system to 1.7 kPa (0.5 in. wg.) of mercury absolute and charge with refrigerant.

- 3.1.4. Test all systems at the specified temperature, set and balance, thermostatic valve adjustments and the like to cause systems to operate at specified conditions.
- 3.1.5. Testing, charging and adjusting shall be witnessed by the Consultant.
- 3.1.6. Refrigeration systems shall conform to the capacities shown in the Schedule.

END OF SECTION 23 23 00.00

- 1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Conform to Section 21 05 00.00– GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
    - 1.1.2. All ductwork construction, support and installation shall be in accordance with the latest ASHRAE, SMACNA, and the base building standards.
  - 1.2. SUBMITTALS
    - 1.2.1. Shop Drawings
      - .1 Submit Shop Drawings of all catalogued components to be supplied. Include manufacturer's data sheets for certification, performance criteria, ratings, and physical dimensions and finishes.
      - .2 Submit Shop Drawings of each supporting structural assembly required in the ductwork systems, designed by an engineer licensed to practice in the place of work in the appropriate discipline. Same design engineer stamps each and every Shop Drawing.
- 2. Products
  - 2.1. MATERIALS
    - 2.1.1. Fabricate all ductwork unless specifically noted otherwise, of galvanized sheet steel with Z180 coating to A.S.T.M. A653/A653M-98.
    - 2.1.2. Sealing compound: Minnesota Mining and Manufacturing or other approved manufacturer. Duct tape shall be Duro-Dyne or other approved manufacturer.
    - 2.1.3. Access Ports shall be Lawson-Taylor or other approved manufacture of 32 mm (1-1/4 in.) dia. ports. Flexible Connections:
    - 2.1.4. Ventfabrics, Duro Dyne or Dyne-Air.
      - .1 For fans less than 0.5 kPa (2 in. wg.) connections shall be minimum 680 gm/sq.m. (20 oz./sq.yd.) fire retardant polyvinyl-chloride polyester fabric equal to Vinyl-Flex.
      - .2 For fans in excess of 0.5 kPa (2 in. wg.) connections shall be minimum 1,080 gm/sq.m. (32 oz./sq.yd.) non-toxic neoprene coated fibreglass fabric equal to Neoprene N.T.
      - .3 For all flexible connections located outside the building (e.g. roof top units) flexible connections shall be fire retardant Hypalon coated fibreglass fabric and shall be a minimum 9915 gm/sq.m. (27 oz./sq.yd.) equal to Hypalon.
    - 2.1.5. Dampers:
      - .1 Dampers: For right angle branch duct take-off from vertical riser; Air vector Vectrol or other approved manufacturer.

- .2 Fire Dampers: Underwriters' Laboratories Classified to ANSI/UL 555 Standard for Fire Dampers and CAN/ULC S112 Standard Method of Fire Test of Fire Damper Assemblies or ANSI/UL 555C Standard for Ceiling Dampers as applicable.
    - .1 Fire dampers shall be curtain type, rated as 'Dynamic', and shall have the blades clear of the air stream. Fire dampers shall be Type B or Type C as required to suit system air velocity and pressure. Fire dampers in return and exhaust systems may be Type A with the blades in the air stream where permitted by the Engineer's Representative. Dampers shall be multi-sectional as required to suit size and UL/ULC Listing requirements. Where the specified curtain fire dampers are limited by the UL/ULC Listing for maximum size, they shall be substituted with multi-blade type complete with power actuation and/or fusible link as required to satisfy the fire rating of the partition.
    - .2 Fire-stop flaps or ceiling mounted fire dampers shall be as shown in the Underwriters' Laboratories Listing for the specific ceiling assembly used.
  - .3 Fabricate manual duct dampers as shown on Standard Details from galvanized steel 1.26 mm thick (0.048 in – 18 GSG gauge) or heavier. Dampers for ducts up to 300 mm (12 in.) deep shall be one blade carried on a 9 mm (3/8 in.) square steel rod mounted inside the duct. Dampers for ducts of greater depth than 300 mm (12 in.) shall be multi-blade, opposed-acting type, and shall have blades mounted in 38 mm (1-1/2 in.) steel channel frame, and interconnected for operation from one locking type hand quadrant. Dampers for right angle take-off of branch from vertical riser shall have operator extended to an accessible location. For externally insulated ducts, mount quadrant on a bracket, designed to clear the insulation. All dampers shall have indicator to show position of damper blade.
  - .4 Fabricate splitter dampers as shown on Standard Details from at least the same thickness of galvanized steel as the duct in which it is installed, down to a minimum of 0.95 mm thick (0.0374 in – 20 GSG gauge). Fabricate of double thickness so that the entering edge presents a round nose to the air flow, and mount securely on hinges at the air leaving edge. Length of splitter shall be at least 1-1/2 times the width of the smaller branch duct, but in no case less than 300 mm (12 in.) long. Attach splitter hinge near the air entering edge with support passing through a clamp on the side of the duct, located where it is most accessible for external adjustment and locking of the damper.
  - .5 Gravity backdraft dampers shall be multi-blade louvre type, constructed of light grade aluminum. Blades shall be joined with a tie bar and have rust-proof shafts rotating in bronze bushings.
  - .6 Motorized dampers for Control Operation: In accordance with applicable requirements control systems (pneumatic) or central energy management systems section.
- 2.1.6. Hardware and Accessories:
- .1 Spin-in connections shall be specifically built for that purpose. Dampers shall be a minimum 1 gauge heavier than the ductwork in which it is installed and shall have a full length shaft pivoted at two diametrically opposed points. An indicator shall be attached to the shaft to indicate the damper position.
  - .2 Hardware for balancing or splitter dampers shall be rattle-free and leak resistant. Bearing rods shall be sized to suit the damper size. Neoprene seals shall be used to minimize leaks. Hardware shall be Dyn-Air or equal.
  - .3 Turning vanes shall be either double thickness or single thickness with extended leading and trailing edges as specified in ASHRAE and SMACNA Standards. Rails shall be securely set in the elbow so that they cannot loosen. Turning vanes shall be Dyn-Air or equal.

2.1.7.

2.2. FABRICATION

2.2.1. Fabricate ductwork in accordance with applicable duct construction requirements of SMACNA.

3. Execution

3.1. INSTALLATION

3.1.1. Make all laps in the direction of air flow. Use no sheet metal screws in the duct where it is possible to use rivets and bolts. Hammer down all edges and slips so as to leave smooth finished surface inside the ducts.

3.1.2. Brace and stiffen all ducts, and make tight so that they will not breathe, rattle, vibrate or sag. Cross-break all rectangular ducts with heights or widths of 300 mm (12 in.) or larger.

3.1.3. Where rectangular ducts are shown, round ducts may be substituted at the Contractor's option, provided there is sufficient room. Conversion from rectangular to round duct, sizing shall be as shown on charts in ASHRAE.

Hang all ductwork securely and in a rigid manner. Provide hangers as follows:

TABLE 1: HANGERS

DUCT DIMENSION	HANGER CONSTRUCTION
<b>Horizontal rectangular duct</b>	
Up to 1500 mm (60 in.) for Low Pressure Ductwork Only	Two 25 mm (1 in.) x 16 US gauge straps with two screws on side of duct one screw on bottom. Hangers shall be at each joint but in no case more than a maximum 2400 mm (96 in.) on centres.

3.1.4. The following low pressure duct construction is based on an ASHRAE method of construction, and gives a minimum standard of construction. Alternative ASHRAE or SMACNA duct construction is acceptable, provided it meets the minimum standards as outlined by these Specifications. Submit proposed alternatives for review prior to fabrication.

3.1.5. Construct low pressure rectangular ducts for systems less than 0.5 kPa (2 in.) static pressure and under 10.2 m/s (2000 fpm) velocity as follows:

TABLE 2: LOW PRESSURE DUCT CONSTRUCTION

MAX. DUCT DIMENSION	SHEET METAL US GAUGE	TRANSVERSE JOINT CONNECTION AND BRACING
Up to 300 mm (12 in.)	26	Flat drive or flat 'S' no bracing
325 mm to 425 mm (13 in. to 18 in.)	24	Flat drive or flat 'S' no bracing

475 mm to 750 mm (19 in. to 30 in.)	24	25 mm (1 in.) standing 'T' bracing 25 mm x 25 mm x 3 mm (1 in. x 1 in. x 1/8 in.) at maximum 1500 mm (60 in.) centres.
775 mm to 1050 mm (31 in. to 42 in.)	22	25 mm (1 in.) standing 'T' bracing 25 mm x 25 mm x 3 mm (1 in. x 1 in. x 1/8 in.) at maximum 1500 mm (60 in.) centres.

- .1 Bracing spacing shown is maximum spacing between two bracings or between bracing and joint.
- .2 Locate bracings mid-way between joints.  
Make longitudinal joints Pittsburgh lock seam at edge of duct, and grooved seam on face of duct.
- 3.1.6. Where ductwork passes through a wall or floor, other than when a fire damper is required, pack around the duct using a fire resistant material to ensure a sound and airtight joint.
- 3.1.7. Select the gauge of metal and method of construction for the new size. Notify the Consultant of any change before such changes are incorporated into the work.
- 3.1.8. If changes of location of duct, are required because of building construction, review with the Consultant before the locations indicated are changed in any way.
- 3.1.9. Make changes of direction of horizontal ducts with elbows having an inside radius not less than 3/4 the width of the duct. Make change of direction from horizontal to vertical duct with elbows having an inside radius equal to the depth of the duct. Where this is not possible due to the building construction, use turning vanes.
- 3.1.10. Provide access ports at convenient locations in all main ducts and main branch take-offs with airtight covers and extension sleeves through insulation to allow air meter readings. Access ports shall be approved by the Consultant and the testing company before installation.
- 3.1.11. Provide balancing dampers for all new duct branches. Provide also balancing dampers and splitter dampers in all new ductwork as requested by the air balancing company.
- 3.1.12. Install motorized dampers where directed.
- 3.1.13. Install fire dampers where shown and at all penetrations through all fire rated assemblies. Where fire dampers are shown in grilles or diffusers at ceiling level they shall be firestop flap.
- 3.1.14. Where fire dampers for ducts shown on Drawings require a change of type and/or powered actuation due to dimension limitations to satisfy the cUL Classification requirements, provide transitions as required to adjust duct dimensions while maintaining the equivalent circular duct diameter to avoid exceeding any specific listed maximum dimension. Where transitions are not possible or dimensions cannot be adjusted to avoid powered actuation, provide power from the closest available emergency power source as required. Review all conditions with the Engineer's Representative in advance of fabrication.
- 3.1.15. Provide access panels at all fire dampers, gravity dampers, motorized dampers, coils, heaters, humidifiers, fan bearings or similar equipment requiring occasional maintenance or inspection. Panels shall be 600 mm x 450 mm (24 in. x 18 in.).
- 3.1.16. Paint visible internal surface behind each grille or register flat black.

- 3.1.17. Where duct is acoustically lined, duct dimensions shown are net, inside of lining.
- 3.1.18. Acoustic lining
- .1 Apply acoustic insulation internally to ductwork where shown. In addition, internally line all low or medium pressure supply air ductwork in mechanical rooms, fan rooms, or equipment rooms.
  - .2 Install using both pins and adhesive. Pins shall be maximum 450 mm (18 in.) centres and shall be tack welded to the duct or plenum. Seal all edges of acoustic insulation to prevent air erosion with sheet metal nosing that overlaps the insulation by 19 mm (3/4 in.) minimum.
- 3.1.19. Ductwork shall be run parallel to the closest wall. Coordinate with piping and structural elements.
- 3.1.20. All open ends of ductwork that do not have a diffuser, grille or register shall have a protective screen mounted in a suitable frame to connect the screen securely to the duct, wall and floor as applicable. Where a duct terminates at a supply, return or exhaust air opening provided by other sections and located less than 2000mm (79 in.) Above the finished floor, the screen shall be installed and painted matte black and shall not be capable of passage of anything larger than a 15mm (1/2 in.) Sphere through the openings.

END OF SECTION 23 31 13.00



1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Conform to Section 21 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
  - 1.2. RELATED WORK SPECIFIED ELSEWHERE
    - 1.2.1. Electrical hard wire supply and primary connections to electrical components – under Electrical Division.
2. Products
  - 2.1. MATERIALS
    - 2.1.1. Roof exhaust fan shall be Penn, Jenn, Greenheck, Loren-Cook, Carnes or Twin City. All roof exhaust fans shall be AMCA rated for air and sound and shall be C.S.A. approved and labelled.
    - 2.1.2. Fan shall be mounted in a square or rectangular roof hood having mounting pedestal to fit on a roof curb. Curb shall be flat for flat roofs and pitched to suit slope of roof for sloped roofs. All curbs shall be acoustically lined. Unit shall be nominally 12" (300mm) high.
    - 2.1.3. Low silhouette exhausters shall be constructed of welded galvanized steel with the entire assembly primed with a zinc rich primer, or it shall be extruded aluminum, treated to prevent corrosion.
    - 2.1.4. Dome type exhausters shall be spun aluminum with rolled edges. All exposed parts shall be heavy gauge aluminum Alloy 3003, and treated to reduce corrosion.
    - 2.1.5. Fans shall be backward inclined, non-overloading sealed bearings rated at 200,000 hours. Drives shall be adjustable to 5.6 kW (7.5 hp).
    - 2.1.6. Motors and drives shall be enclosed in a weatherproof compartment, separately ventilated from the exhaust air stream.
    - 2.1.7. Unit shall be complete with a non-corrosive bird screen.
    - 2.1.8. Provide gravity dampers with neoprene edges on the outlet of all fans.
    - 2.1.9. Factory mount a C.S.A. approved disconnect switch under the hood, adjacent the electric motor.
    - 2.1.10. Roof fan for laboratory exhaust shall be similar to the above with the exception that it shall be arranged for vertical discharge and shall have Eisen-Heiss or equal protective coating.
    - 2.1.11. Unit shall be mounted on a Penn Uni-Beam prefabricated roof curb to match the fan size. Curb shall be flat for flat roofs and pitched to suit slope of roof for sloped roofs. All exhaust

curbs, except for kitchen and laboratories, shall be acoustically lined. Unit shall be nominally 300 mm (12 in.) high.

2.1.12. Kitchen exhaust fans shall be similar to the above except that fan shall be U.L.C. approved for smoke and grease vapours (440 E22), meet N.F.P.A. 96A, shall have a grease collection device and a roof curb to meet N.F.P.A. 96A and of sufficient height to meet Code requirements.

2.1.13. Noise level shall be such that noise criterion 45 is maintained at the building entrances, walkways, and adjacent windows.

2.1.14. Roof exhaust fans shall be in accordance with the following:

- .1 EF- - Greenheck Model No. CSP-700A , 752 CFM, 0.125 e.s.p. and 350 WATTS  
3.2 AMPS 1100RPM.

3. Execution

3.1. INSTALLATION

3.1.1. Install roof exhaust fans in accordance with reviewed Shop Drawings, and in accordance with manufacturer's installation instructions.

3.1.2. Attach hoods with non-ferrous bolts and nuts, and make readily removable.

END OF SECTION 23 34 63.00

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 21 05 00.00– GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

1.2. SUBMITTALS

1.2.1. Shop Drawings: Submit detailed Shop Drawings of all components furnished under this Section. Manufacturer to indicate ceiling installation type for each type of diffuser specified.

2. Products

2.1. MATERIALS

2.1.1. Diffusers, registers and grilles shall be Price, Nailor, Krueger, Titus or Carnes equal to the units specified.

2.1.2. Select all diffusers to provide uniform air coverage without overlap. Air velocity up to a height of 1800 mm (6 ft.) above the floor shall be 0.127 to 0.254 m/s (25 to 50 fpm).

2.1.3. Noise generated by diffusers shall be such that room sound pressure level does not exceed noise criteria 32 with 8 db room attenuation, the sound power level reference to 10 to –12 power watts.

2.1.4. All volume and air pattern devices shall be fully adjustable from the face of the diffuser, register or grille.

2.1.5. Diffusers shall meet test requirements of A.S.H.R.A.E. Standard 36B-63, including air pattern and noise levels for air quantities from 10% to 110% of the required maximum air flow. Sound power tests shall be measured in accordance with ASHRAE Standards 36B-63 and NC ratings shall be determined using an 8 db room attenuation factor

2.1.6. RETURN, EXHAUST AND TRANSFER GRILLES

2.1.7. Return grilles shall be size as shown and shall be egg crate type with aluminum construction. Egg crate shall be 12 mm (1/2 in.) deep, formed of 12 mm (1/2 in.) wide aluminum strips on 12 mm (1/2 in.) centres. Strips shall be approximately 0.64 mm (0.025 in.) thick. Grilles shall be enclosed in a channel frame for inverted T-bar mounting or with a flanged frame for plaster or gypsum ceiling mounting. Grilles shall lay on inverted T-bar ceiling suspension system. Colour shall match adjacent ceiling tiles. E.H. Price Series 80, Nailor 5100 Series, Krueger EGC5 Series, Carnes RAPAH.

3. Execution

3.1. INSTALLATION

- 3.1.1. Refer to the architectural drawings for actual locations of diffusers, grilles and registers and install to suit these drawings. The mechanical drawings show intent and number of diffusers, grilles and registers required.
- 3.1.2. For exposed ductwork installations, all connections to grilles shall be oversized and shall have in-turned flanges to meet the flange of the grilles and the duct. Out-turned or exposed flanges with screw mounting shall not be accepted.
- 3.1.3. For special mounting of diffusers, grilles and registers refer to Architectural Drawings.
- 3.1.4. Where rigid duct is connected to the diffuser, grille or register all devices used for flow pattern adjustment, flow balancing and flow equalizing shall be accessible from the face of the diffuser.

END OF SECTION 23 37 13.00

1. General

1.1. WORK INCLUDED

1.1.1. Conform to Section 21 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.

2. Products

2.1. MATERIALS

2.1.1. Unitary Air Conditioning Units (UACU) shall be Mitsubishi, Daiken, Carrier, LG, or Sanyo.

2.1.2. UACU shall be split system type with minimum two speed indoor evaporator section and remote outdoor compressor/condensing unit.

2.1.3. Model arrangements shall be as shown, and specified below.

Unit Tag	Model #	kW (MBH)	Location
AC-01	MSZ-GE24NA	7.47 (24)	EVIDANCE ROOM
CD-01	MUZ-GE24NA		LOADING DOCK
AC-02	MSZ-GE36NA	10.6 (36)	OFFICE ROOM
CD-02	MUZ-GE36NA		LOADING DOCK

2.1.4. The combination of the evaporator and condensing sections shall be provided with the capacities designated in the schedule above.

2.1.5. Outdoor condensers shall require a 208/1/60 single point electrical connection. Evaporators shall be powered and controlled from its related outdoor condenser. Where a unit manufacturer requires separate electrical connections for each component, this Section shall arrange and pay for all interconnecting wiring or dedicated service for a complete and operational system.

2.1.6. Compressor condensing unit shall be capable of low temperature operation down to -34.4 deg. C. (-30 deg. F.).

2.1.7. Provide unit with room thermostat. Dampers for right angle branch duct take-off from vertical riser shall be Air Vector, Vectrol, or other approved manufacturer.

2.1.8. Unit shall be provided with filter.

2.1.9. Provide an automatic condensate pump system and reservoir where indicated on the drawings, or where required to lift condensate back to the plumbing system.

- 2.1.10. Digital Thermostat: 7-day programmable digital type suited for the application, user selectable engineering units (F or C) and set point adjustment, support automatic daylight savings time switchover and automatic heat/cool changeover when applicable.

3. Execution

3.1. INSTALLATION

- 3.1.1. Install complete refrigeration and controls in accordance with the manufacturer's recommendations.
- 3.1.2. Roof mounted condensers shall be installed as shown in the Mechanical Standard Details.
- 3.1.3. All indoor units shall be indirectly drained to the nearest floor drain.

END OF SECTION 23 81 26.00

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Conform to Section 21 05 00.00 – GENERAL INSTRUCTIONS FOR MECHANICAL SECTIONS.
  - 1.2. RELATED WORK SPECIFIED ELSEWHERE
    - 1.2.1. Electrical hard wire supply and primary connections to electrical components, under Electrical Division.
2. Products
  - 2.1. MATERIALS
    - 2.1.1. Steam humidifiers shall be of the type designed to inject steam into air handling units, or for injecting steam into ductwork as shown. Industrial applications may use atomizer humidifiers as required.
    - 2.1.2. The humidifier shall provide absorption characteristics that preclude water accumulation on any surface within 900 mm (36 in.) downstream of the humidifier tube panel. Provide computer-based program confirming absorption distance.
  - 2.2. CENTRAL PLANT STEAM HUMIDIFIERS
    - 2.2.1. Steam humidifiers shall be manufactured by Armstrong Machine Works, Dri-steam, or Spirax Sarco, Nortec, Neptronic. Steam humidifiers shall be factory assembled and shall include a stainless steel steam jacketed perforated distribution manifold, a stainless steel condensate separating chamber, a normally closed stem control valve, a stainless steel muffler and a full length internal silencing screen in the distribution manifold. A strainer and steam trap shall be furnished with each humidifier. Humidifier shall have steam delivery capacity as shown. Steam distribution manifolds shall be of sufficient length to penetrate at least 75% of the duct width. Installation shall be in accordance with the manufacturer's written installation instructions. Multi-manifold units shall be trapped at bottom of legs of manifolds and separators.
    - 2.2.2. Capacity shall be equal to 22.8 lb/hr , 120/1 amps 33.3
  - 2.3. ATOMIZER HUMIDIFIER
    - 2.3.1. Humidifiers shall be manufactured by Walton Laboratories, Neptronic Jetspray, Nortec.
    - 2.3.2. Duct humidifiers shall be of the centrifugal atomizer type, with a sealed motor section, disc, pump tube and copper reservoir and all parts exposed to water made of non-ferrous materials. Duct humidifiers shall be suitable for operating water pressure up to 520 kPa (75 psig) and 115 volt/1 phase/60 cycle power supply with 100 watt power input. Capacities shall be as shown in the Schedules.
  - 2.4. EXECUTION
  - 2.5. INSTALLATION

- 2.5.1. Install humidifier in accordance with manufacturers' instructions. The system shall be installed in accordance with recognized industry practices to ensure that humidification systems comply with requirements and serve intended purposes.
- 2.5.2. Install all accessories provided with humidifiers in accordance with manufacturers' instructions.
- 2.5.3. Provide access space around humidification system components for service as indicated by manufacturer.
- 2.5.4. Install piping from automatic drain valve to nearest floor drain. Provide suitable back flow prevention devices as required by local Plumbing Code. Provide drain piping for overflow and drain on steam generators sloped 1 in 25, terminating over floor drain with an air gap.
- 2.5.5. Install flexible hose or rigid pipe between humidifier outlet and steam distribution pipes. Insulate the complete length.
- 2.5.6. Perform all field wiring between all sensors and humidifier in accordance with requirements of the Electrical Division.
- 2.5.7. Provide and install condensate piping from condensate separator to nearest floor drain.
- 2.5.8. Mount control cabinet adjacent to the humidifier.
- 2.5.9. For Central Plant Humidifiers, BAS connection to humidifier provided under Section 23 09 00.00 – BUILDING AUTOMATION SYSTEM (BAS).

END OF SECTION



- 2.5.1. Install humidifier in accordance with manufacturers' instructions. The system shall be installed in accordance with recognized industry practices to ensure that humidification systems comply with requirements and serve intended purposes.
- 2.5.2. Install all accessories provided with humidifiers in accordance with manufacturers' instructions.
- 2.5.3. Provide access space around humidification system components for service as indicated by manufacturer.
- 2.5.4. Install piping from automatic drain valve to nearest floor drain. Provide suitable back flow prevention devices as required by local Plumbing Code. Provide drain piping for overflow and drain on steam generators sloped 1 in 25, terminating over floor drain with an air gap.
- 2.5.5. Install flexible hose or rigid pipe between humidifier outlet and steam distribution pipes. Insulate the complete length.
- 2.5.6. Perform all field wiring between all sensors and humidifier in accordance with requirements of the Electrical Division.
- 2.5.7. Provide and install condensate piping from condensate separator to nearest floor drain.
- 2.5.8. Mount control cabinet adjacent to the humidifier.
- 2.5.9. For Central Plant Humidifiers, BAS connection to humidifier provided under Section 23 09 00.00 – BUILDING AUTOMATION SYSTEM (BAS).

END OF SECTION

SECTION	NUMBER	NAME	PAGES
	26 01 00.00	Operating and Maintenance Instructions	3
	26 05 01.00	General Instructions for Electrical Sections	16
	26 05 03.00	Record Drawings	3
	26 05 04.00	Submittals/Shop Drawings	2
	26 05 05.00	Mounting Heights	2
	26 05 21.00	Wires and Cables 1000V	6
	26 05 26.00	Grounding and Bonding	4
	26 05 29.00	Hangers and Supports	2
	26 05 31.00	Splitters, Junction, Pull boxes and Cabinets	2
	26 05 32.00	Outlet Boxes, Conduit Boxes and Fittings	3
	26 05 34.00	Conduits, Conduit Fasteners and Fittings	4
	26 05 53.00	Identification	4
	26 05 63.00	Access Doors and Accessibility	2
	26 05 83.00	Sleeves	2
	26 05 88.00	Cutting and Patching	2
	26 24 17.00	Panelboards - Breaker Type	3
	26 27 26.00	Wiring Devices	4
	26 28 21.00	Moulded Case Circuit Breakers	2
	26 28 23.00	Disconnect Switches - Fused and Non-Fused	2
	26 51 13.00	Lighting Equipment	9
	26 52 01.00	Unit Equipment for Emergency Lighting	3
	28 31 01.00	Conventional Fire Alarm System	2

Panel Schedule  
Panel RP-1H

END OF SECTION 26 00 00.00

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
    - 1.1.2. Section 26 05 03.00 – RECORD DRAWINGS.
    - 1.1.3. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
    - 1.1.4. Section 26 08 00.00 – COMMISSIONING.
    - 1.1.5. Section 26 08 01.00 – TECHNICAL SERVICES DIVISION START-UP SERVICE.
2. Products
  - 2.1. NOT USED
3. Execution
  - 3.1. REQUIREMENTS FOR MANUALS
    - 3.1.1. A minimum of three copies of complete and approved operating and maintenance instructions for all electrical equipment and systems shall be supplied before substantial completion. Provide additional copies if required under the General Requirements. In addition to the three copies of manuals, the contractor to provide a manual in a searchable PDF format on CD or DVD or USB stick. As-Built Drawings to be included on the CD or DVD or USB stick.
    - 3.1.2. The contractor to identify the cost of Record Drawings and the Operation and Maintenance Manuals as a separate line item on their progress draw. The values to be broken out can be found in Section 26 05 03.00 – Record Drawings. The project will remain incomplete and no money will be released until the final versions, both hard and electronic, of the drawings and manuals are received and reviewed without comments.
    - 3.1.3. Binders shall be three-ring, hard-cover, loose-leaf type and identified on the binding edges as “Maintenance Instructions and Data Book”, for “(Project Name)”.
    - 3.1.4. Terminology used in all the sections shall be consistent.
    - 3.1.5. Volume One shall contain the master index of all systems, the name of the Contractor, Electrical Subcontractors and the date of substantial performance for the Contract.
    - 3.1.6. Volume One shall contain a section with all necessary warranty information.
    - 3.1.7. Each binder shall have a complete index for all volumes.
    - 3.1.8. Each binder shall be no more than half filled.
    - 3.1.9. There shall be a separate section for all materials used on the project which fall under the WHMIS legislation. There shall be an MSDS, hazard data sheet, for each of the materials.
    - 3.1.10. There shall be a separate section for all Insurance Certificates, Test Certificates, Verification Forms and Test Forms.
    - 3.1.11. All relevant information relating to a system or product shall be contained within one binder.
    - 3.1.12. The manual sections shall follow the specification sections.

- 3.1.13. Any diagrams, installation drawings, single line diagrams charts, etc. shall be mechanically reduced while maintaining full legibility to standard page size. If this cannot be achieved they shall be carefully folded and contained within a clear plastic wallet within the manual.

### 3.2. DATA FOR MANUALS

#### 3.2.1. Equipment data shall contain:

- .1 Operating instructions.
- .2 Operating conditions such as temperature and pressure.
- .3 Location of equipment.
- .4 Maintenance instructions and schedules for one year routine.
- .5 Recommended list of spare parts.
- .6 Maintenance schedule.
- .7 A trouble shooting table showing where to look for problems under various conditions of malfunction.
- .8 All wiring diagrams.
- .9 Equipment operating curves.
- .10 Equipment nameplate data and serial numbers.

#### 3.2.2. System data shall contain:

- .1 A listing of all systems.
- .2 All panel, mcc and fire alarm schedules and locations.
- .3 Equipment name tags.
- .4 Cleaning, maintaining and preserving instructions for all material, products and surfaces. Include warnings of harmful cleaning, maintaining and preserving practices.

#### 3.2.3. Sub-Contractor manuals are required for:

- .1 Switchboards and power distribution systems.
- .2 Lighting systems.
- .3 Emergency power systems.
- .4 Fire alarm systems.

#### 3.2.4. As-Built documentation shall contain:

- .1 Reviewed As-Built Shop Drawings.
- .2 As-Built Construction Drawings.
- .3 Originals of test forms.
- .4 Originals of test certificates.

### 3.3. OPERATING INSTRUCTIONS

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

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

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

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

- 3.3.5. Arrange for and pay for the services of engineers and other manufacturers' representatives required for instruction on the systems and the equipment as requested by the Engineer's Representative and/or the Owner.
- 3.3.6. At the time of final review, provide a sheet for each system and piece of equipment showing the date instructions were given. Each sheet shall show the duration of instruction, name of persons receiving instruction, other persons present (manufacturer's representative, Engineer's Representative, etc.), system or equipment involved and signature of the Owner's staff stating that they understood the system installation, operating and maintenance requirements. This information shall be inserted in the manuals after all instructions have been completed.
- 3.3.7. Review information with the Owner's representative to ensure that all information required has been provided.
- 3.3.8. Electrical equipment and systems included in the instruction requirements, include but not limited to the following:
  - .1 Switchboards and related power distribution equipment.
  - .2 Emergency generator.
  - .3 Automatic transfer switches.
  - .4 Fire alarm systems.
- 3.4. TRIAL USAGE
- 3.4.1. The Owner shall be permitted trial usage of systems or parts of systems for the purpose of testing and learning operational procedures. Trial usage shall not affect the warranties nor be construed as acceptance, and no claim for damage shall be made against the Owner for any injury or breakage to any part or parts due to the tests, where such injuries or breakage are caused by a weakness or inadequacy of parts, or by defective materials or workmanship of any kind.

END OF SECTION

1. General
- 1.1. WORK INCLUDED
- 1.1.1. Conform to the requirements of Division 1, which applies to and forms part of all sections of the work.
- 1.1.2. Section 26 00 05.00 – REGIONAL SUPPLEMENTAL REQUIREMENTS.
- 1.2. DESCRIPTION OF SECTION
- 1.2.1. The specification is divided into sections of work and a section may consist of the work of more than one subcontractor. The responsibility as to which electrical subcontractor provides labour, materials, equipment and services required to complete the work rests solely with the Electrical Contractor.
- 1.3. SECTIONS AFFECTED
- 1.3.1. These instructions apply to and form a part of all electrical sections.
- 1.4. SCOPE
- 1.4.1. Provide all labour, materials, equipment and services to complete the work of the electrical division as further specified and as shown on the drawings.
- 1.4.2. Should any discrepancy appear between any parts of the specifications and/or the drawings to cause doubt as to the true meaning and intent of the drawings and specifications, a ruling shall be obtained from the Engineer's Representative before submitting the tender. If this is not done the following will be assumed:
  - .1 Where a discrepancy occurs between the specification and the drawings, the drawings take precedence.
  - .2 Where a discrepancy occurs in the drawings the more expensive/onerous alternative will be deemed as included in the contract.
  - .3 Where a discrepancy occurs in the specifications the more expensive/onerous alternative will be deemed as included in the contract.
- 1.5. REGULATIONS
- 1.5.1. All work shall be performed in accordance with the latest codes, rules, regulations, by-laws and requirements of all authorities having jurisdiction except where the requirements of the drawings and specifications exceed the codes, rules, regulations, by-laws and requirements of the authorities having jurisdiction.
- 1.5.2. These specifications are supplementary to the requirements above.
- 1.5.3. Drawings and specifications should not conflict with the above regulations but where there are apparent discrepancies the contractor shall notify the Engineer's Representative.
- 1.6. PERMITS, FEES, AND REVIEWS
- 1.6.1. Make submissions to obtain all permits. Include for and pay for all fees and arrange for all reviews required for the work of this division.
- 1.6.2. If required by code, plans and specifications have been previously submitted to the Authority Having Jurisdiction.


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- 1.6.3. Furnish certificates of Acceptance from the Authority Having Jurisdiction and include them in the Operation and Maintenance manual.
- 1.7. VOLTAGE RATINGS
- 1.7.1. Operating voltages are as specified in CAN3-C235-(latest edition).
- 1.7.2. Motors, electric heating, control and distribution devices and equipment are to operate satisfactorily at 60 Hz within operating limits established by the above standard.
- 1.8. COORDINATION WITH MECHANICAL DIVISIONS.
- 1.8.1. Unless indicated otherwise on the Electrical Drawings, Electrical Contractor will be responsible for the supply and installation of the following:
- .1 Starters.
  - .2 Line and load side wiring for starters.
  - .3 Reduced voltage starters including "Soft Start" starters.
  - .4 Line and load side wiring to variable speed drives, including but not limited to wiring of associated harmonic filters, AC line input reactors, dV/dT filters, and output filters.
  - .5 Provisions of disconnects to all mechanical equipment.
  - .6 All power wiring (120V & above) to all mechanical equipment.
  - .7 Electrical ramp heating cables and controls.
  - .8 All motorized damper power connections (120V & above).
  - .9 Fire alarm devices.
  - .10 Wiring to electric space heaters.
- 1.8.2. Mechanical Divisions will be responsible for the supply and installation of the following:
- .1 All variable speed drives and control wiring to starters.
  - .2 Pipe tracing and related controls.
  - .3 Electric hot water heaters.
  - .4 All electrical heaters including baseboard heaters, cabinet heaters, force flow heaters and radiant heaters.
  - .5 All interposing relays, relays, contactors and 120V control devices.
  - .6 All 120V and low voltage control wiring and conduits.
- 1.8.3. Determine exact location of starters, motors and line voltage controls based on the mechanical drawings to coordinate with the locations of all equipment to ensure the required clearances are maintained. If no wall location is suitable for the motor starters then mount the starters on a plywood backboard on unistrut supports near the respective equipment to meet the applicable code requirements for motor isolation switches. If a motor or piece of equipment is listed on one of the starter schedules but is not shown on the floor plans, the contractor is to reference the mechanical drawings for the location of the respective piece of equipment. No additional costs will be entertained.
- 1.8.4. Should the mechanical contractor change any of the motor or equipment sizes from those identified on the mechanical schedules and drawings at any stage of the project to aide their installation, the mechanical contractor will incur all extra electrical costs to revise the electrical feeders, breakers, starters and equipment to supply power to the revised piece of equipment.
- 1.9. PLYWOOD BACKBOARDS, EQUIPMENT MOUNTING, & HOUSEKEEPING PADS

- 1.9.1. Provide fire rated plywood backboards as shown on the drawings and mount where all communication equipment is to be wall mounted. Plywood is to be 21 mm, urea-formaldehyde (UF) free and shall be either, Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI) or CSA Z809-(latest edition) certified. Plywood to be either fire rated with the appropriate label displayed once installed or coated with fire retardant paint. Do not paint over plywood fire rating certification stamp. All Certification not to be painted. Submit documentation as a shop drawing for review by the LEED Representative prior to ordering.
- 1.9.2. Surface mounted electrical equipment boxes are to be installed on galvanized unistrut stand-offs. Electrical equipment boxes shall include, but not be limited to electrical panels, LV lighting control, fire alarm, security, communication, electrical sub-metering, etc. Panels are to be grouped on common base wherever practical.
- 1.9.3. Provide steel re-enforced concrete housekeeping pads under all floor mounted electrical equipment and where noted on the drawings. All housekeeping pads to be a minimum of 100mm high above finished floor and shall not extend beyond 50mm beyond the electrical equipment unless shown otherwise on the drawings.
- 1.10. FINISHES
  - 1.10.1. Metal enclosure surfaces are to be finished by the application of rust resistant primer on both the inside and outside, with at least two coats of enamel.
  - 1.10.2. Clean and touch up all surfaces of equipment scratched or marred during shipment or installation. Match the original paint.
  - 1.10.3. Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
  - 1.10.4. All paints, coatings, sealants and adhesives shall meet the VOC limits in accordance with the LEED Specification sections. Submit documentation as a shop drawing for review by the LEED Representative prior to ordering
- 1.11. SAFETY
  - 1.11.1. Protect exposed live equipment during construction for personnel safety.
  - 1.11.2. Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.
  - 1.11.3. Arrange for the installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of an electrician.
- 1.12. FIRE STOPS
  - 1.12.1. Provide fire stops in accordance with front end, and Division 1 documents and as describe herein. Contractor to coordinate fire stops with General Contractor. All paints, coatings, sealants and adhesives shall meet the VOC limits in accordance with the LEED Specification sections. Submit documentation as a shop drawing for review by the LEED Representative prior to ordering.
  - 1.12.2. Fire stops and smoke seal systems: in accordance with CAN/ULC-S115 (latest edition).
    - .1 Asbestos free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN/ULC-S115 (latest edition) and not to exceed opening sizes for which they are intended.
    - .2 Fire stop system rating for service penetrations: to suit the latest edition of the National Building Code of Canada with local amendments or the Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.
    - .3 Fire stop system rating for sealing junction of rated walls to rated floors and ceilings: to suit the National Building Code of Canada with local amendments or the



Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.

- 1.12.3. Service penetration assemblies: certified by ULC in accordance with CAN/ULC-S115 (latest edition) and listed in ULC Guide No. 40 U19.
- 1.12.4. Service penetration fire stop components: certified by ULC in accordance with CAN/ULC-S115 (latest edition) and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.
- 1.12.5. Fire resistance rating of installed fire stop assembly not less than the fire resistance rating of surrounding floor and wall assembly, and in accordance with the National Building Code of Canada with local amendments or the Local/Provincial Building Code, and meet requirements of local authority having jurisdiction.
- 1.12.6. Fire stops and smoke seals at openings intended for ease of re-entry, such as cables: elastomeric seal; do not use cementitious or rigid seal at such locations.
- 1.12.7. Fire stops and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal; do not use a cementitious or rigid seal at such locations.
- 1.12.8. Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- 1.12.9. Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- 1.12.10. Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- 1.12.11. Sealants for vertical joints: non-sagging.
- 1.12.12. Colour: if range available to Engineer's Representative's choice of standard colours, generally to match background colour where visible in finished spaces.
- 1.12.13. Through non-fire or non-smoke separations or where waterproof membrane is field applied, where pipes are insulated, sleeves shall be sized to accommodate the insulation and vapour barrier.
- 1.12.14. Where holes are core drilled in existing structures, sleeves shall be provided as specified complete with fire stopping as noted above.
- 1.12.15. Submit a complete fire stop system shop drawing package, identifying the products that may be used on the project. Prior to submitting data, review with Authority having Jurisdiction to confirm acceptability of proposed materials and assemblies.
- 1.12.16. Installation
  - .1 Install fire stops and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.
  - .2 Seal holes or voids made by through penetrations, poke through termination devices, and un-penetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
  - .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
  - .4 Tool or trowel exposed surfaces to a neat finish.
  - .5 Remove excess compound promptly as work progresses and upon completion.
- 1.13. HOISTING

- 1.13.1. Electrical Contractor will be responsible for the hoisting of all the equipment in the contract. Contractor to coordinate with General Contractor for use of the general hoisting facilities. If hoist facilities are inadequate then subcontractors must provide their own. Subcontractors must inform general contractors in writing of requirements before tender closing date. Any hoisting required in addition to that provided by the General, will be included in the bid price.
- 1.13.2. Electrical Contractor to include for the qualified millwrights to move and place all equipment over 1000lbs. Contractor to provide proof of millwright certification.
- 1.14. CLEANING AND WASTE REMOVAL
  - 1.14.1. Clean all electrical equipment that has been exposed to construction dust and dirt.
  - 1.14.2. Contractor to clean all electrical equipment, inside and out, prior to turn over to Owner. Equipment is subject to review by Engineer's Representative and/or Owner.
  - 1.14.3. Contractor is responsible to remove their own waste from the site. All re-usable materials shall be recycled.
- 1.15. SPRINKLERS
  - 1.15.1. All electrical equipment shall be suitable for installation in a sprinklered environment and enclosures are to be CSA Type-2 sprinkler proof.
- 1.16. TEMPORARY LIGHT AND POWER
  - 1.16.1. Temporary light and power for construction shall be provided, metered, and maintained by the electrical trade, as directed by the General Contractor; but each trade shall provide all extension cords, lamps, etc., required to complete their work.
  - 1.16.2. All temporary light to be fluorescent. Provide adequate lighting to meet all health and safety standards.
- 1.17. EXAMINATION AND PROTECTION OF SITE
  - 1.17.1. Before submitting Bid, each trade shall examine the site to determine the conditions which may affect the proposed work. No claims for extra payment will be considered because of failure to fulfil this condition 
  - 1.17.2. Contractor to document any existing conditions on site and submit a pre-condition survey including pictures. Contractor will be responsible to return the site back to its original form, which includes but is not limited to ground repair including grading and new sod and repair of damaged walls, doors and/or floors.
  - 1.17.3. Contractor is to protect trees and plants on site and on adjacent properties. Plants to be protect with burlap. Trees and roots within construction area to be protected by the erection of temporary 2m high plywood hoarding at the drip line of the tree. Contractor to avoid unnecessary traffic, dumping and storage of materials at or near trees or plants.
  - 1.17.4. When requested by the Owner and/or Engineer's Representative, the Contractor is to provide digital pictures of the site, including but not limited to progress of work and installed equipment, via e-mail to the Owner and/or Engineer's Representative.
- 1.18. DRAWINGS AND INSTALLATION
  - 1.18.1. The drawings are intended to show the general character and scope of the work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operative installation.

- 1.18.2. The location, arrangement and connection of equipment and materials shown on the drawings represent a close approximation to the intent and requirements of the contract. The right is reserved by the Engineer's Representative to make reasonable changes required to accommodate conditions arising during the progress of the work, at no extra cost to the Owner.
- 1.18.3. Certain details indicated on the drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details shall be applicable to every occurrence on the drawings.
- 1.18.4. The actual location of switches, outlets and luminaries, etc. shall be reviewed by the Engineer's Representative before installation.
- 1.18.5. The location and size of existing services shown on the drawings are based on the best available information. The actual location of existing services shall be verified in the field before work is commenced. Particular attention shall be paid to buried services.
- 1.18.6. Changes and modifications necessary to ensure co-ordination and avoid interference and conflicts with other trades or to accommodate existing conditions, shall be made at no extra cost to the Owner.
- 1.18.7. Leave areas clear where space is indicated as reserved for future equipment, and equipment for other trades.
- 1.18.8. Adequate space and provisions shall be left for removal of components and servicing of equipment, with minimum inconvenience to the operation of systems.
- 1.18.9. Where equipment is shown to be 'roughed-in only' obtain accurate information from the Engineer's Representative before proceeding with the work.
- 1.18.10. Contractor is to review Architect's specifications, drawings and details to confirm locations of devices and equipment.
- 1.18.11. This Contractor is responsible to mark-out his work, fully co-ordinated with all other trades, in sufficient time for review by Architectural Consultant prior to rough-in. Prepare dimensioned layouts of each room prior to rough-in for review by Architectural Consultant. Do not proceed with any work until the Architectural Consultant has reviewed the layout drawings.
- 1.18.12. The Contractor will reimburse the Engineer's Representative for their time spent on answering any written questions or requests for information where the answer is clearly identified on the drawings or in the specifications.
- 1.19. INSTALLATION, INTERFERENCE AND SETTING DRAWINGS
- 1.19.1. The Contractor is to complete installation, interference and setting drawings, dimensioned and to scale for all systems. They shall be made available for review by the Engineer's Representative, if requested. The drawings are required to make clear the work intended or to show its relation to adjacent work or to the work of other trades. When an alternative piece of equipment is to be substituted for equipment shown, drawings of the area involved shall be prepared by this division.
- 1.19.2. Slab layout drawings are to be submitted for review by the Structural Engineer's Representative. These slab layout drawings are to be included in the as-built drawings. Refer to Section 26 05 03.00 – RECORD DRAWINGS.
- 1.19.3. Interference drawings are required for shafts, ceiling spaces, basement areas, typical floors and wherever there is possible conflict in the positioning of electrical equipment, piping, ductwork sub-trades or architectural features.
- 1.19.4. This Division shall prepare sleeving drawings indicating the size and locations of openings required in concrete floor slabs, roof slabs/decks and walls for conduit, bus ducts and equipment for review by the Structural Engineer and Architect. In case of failure to provide

information in time (i.e. before the concrete is poured) any extras incurred shall be at the expense of this Division.

1.20. PRODUCTS AND MATERIALS

- 1.20.1. Make and quality of materials used in the construction of this project shall be subject to the approval of the Engineer's Representative.
- 1.20.2. All equipment and material are to be CSA certified or approved by an accredited organization. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Authorities.
- 1.20.3. Factory assemble control panels and component assemblies.
- 1.20.4. Materials and equipment supplied by this division shall be new and free from defects and shall be equivalent in physical characteristics and performance to that specified by the manufacturer's name and catalogue reference.
- 1.20.5. Where a certain manufacturer's equipment has been specified by name or model number, the contractor shall be responsible for ensuring that the performance and quality meets the specified equipment and that the same access or maintenance space is available for an alternative manufacturer's equipment that is used and that interfacing connections with other trades can be made at no extra cost.
- 1.20.6. Within 30days of the award of contract, the Contractor is to submit a complete list of the manufacturers for all equipment being supplied on the project.
- 1.20.7. Availability
  - .1 In submitting Bid, Contractor warrants that all materials are available in suitable time to meet Contract dates.
  - .2 Subject to sentence .3 below, where the Contractor advises that the Contractor cannot supply materials in suitable time to meet Contract dates, and should it subsequently appear that Work may be delayed for such reason, the Engineer's Representative reserves the right to substitute more readily available products of similar character, even if more costly to the Contractor, at no increase in Contract Price.
  - .3 Where the Contractor can show that the Contractor promptly ordered the originally specified materials the Owner will pay the differential in cost between the originally specified material and the substitute material without any mark-ups applicable by the Contractor, subcontractors, sub-subcontractors or suppliers. For greater certainty, the Contractor's failure to submit shop drawings or other submittals or seek direction in those instances where the Contract Documents so require in sufficient time to permit ordering materials is not cause for the Owner to pay the cost differential in sentence .2 above.

1.21. CO-OPERATION WITH CONSULTANTS

- 1.21.1. To assist in the successful execution of the project, the Contractor shall receive a job report that summarizes the expectations of the Consultant and the Contractor. This document covers topics such as progress billings breakdowns, shop drawing requirements, change order pricing breakdowns, the commissioning process, installation drawings, the specifications, as-built drawings and O+M manuals, along with a number of other items. This job report is intended to reiterate and elaborate on key items of the Contract Documents and is not intended to impose new requirements.
- 1.21.2. At the appropriate time during construction the Contractor shall submit the applicable documentation listed in the "Mechanical/Electrical Unfinished Building Occupancy Checklist". The list shall be issued by the Consultant during the course of the project; however, a sample checklist can be provided at any time upon request. The checklist shall be completed by the

Contractor when the information required for occupancy is submitted. The Consultant shall review the information and checklist and shall identify when the information is complete. The Consultant's general review letter (required for building occupancy) shall only be issued when all the information requested in the checklist is submitted by the Contractor and deemed to be complete by the Consultant.

1.22. CO-OPERATION WITH OTHER DIVISIONS

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

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

1.22.3. Each section shall confine itself to installing all materials in the spaces shown without encroaching upon space for materials installed under other sections or divisions. Where the space allocated to another section or division is encroached upon, the materials shall be relocated to their proper space allocation in such a manner to complete the work using space allocated to the various sections and divisions. Relocation of materials and work involved shall be paid for by the section responsible for the encroachment at no extra cost to the Owner.

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

1.22.5. The Electrical Contractor shall coordinate the exact breaker/fuse sizes with all mechanical equipment shop drawings prior to rough-in and ordering of the electrical distribution equipment. Size of breakers/fuses shown on drawings are based on generic equipment manufacturers and sizes may change depending on successful equipment manufacturer. No additional costs shall be allowed for non-coordinated mechanical shop drawing reviews by the Electrical Contractor.

1.23. TEMPORARY USE OF EQUIPMENT

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

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

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

1.24. STATEMENT OF PRICES

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

- 1.24.2. The total price of all portions of the work shall equal the total price of the work covered under the electrical division. Cost for as-built drawings and manuals to be carried as a separate line item.
- 1.24.3. Contractor to list and track all fixed per unit cost luminaires as part of Light Fixtures - Materials on the progress draw.
- 1.24.4. Contractor to list and track each of the approved changes on separate lines on the progress draw.
- 1.24.5. Costs of temporary facilities and utilities shall be amortized over the duration of the Work. Claims for 'mobilization', 'bidding costs', or similar lump sums at or before start of work are not acceptable.

## EXAMPLE PROGRESS DRAW

Electrical Contractor Name  
Billing Application Electrical Division  
Project Name

Application Number – xx

Date – xxxx to xxxx

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

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

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

## 1.25. METRIC CONVERSIONS

1.25.1. Particular care shall be taken with imperial versus S.I. metric conversions. This applies to all services including, but not limited to, equipment, conduit and site services in both new and existing installations.

## 1.26. INTERRUPTION OF SERVICES

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

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

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

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

- 
- 1.26.5. Contractor to provide a minimum of 5 days written notice of a requirement for a shutdown. Contractor to include for separate meetings with the Owner and Engineer's Representative to discuss the shutdown in detail and to coordinate all the work being performed.
- 1.26.6. The Contractor is responsible for co-ordination and isolating of all existing services at all voltage levels required for the disconnections and connections to existing buildings. This includes shutting down and isolating existing low and medium voltage services. The owner will not perform any isolations for the contractor but will be present during the work. The contractor is to use qualified personnel for these shutdowns ensuring compliance with all applicable safety requirements.
- 1.26.7. The Contractor is responsible for any damages caused to existing systems when making connections.
- 1.26.8. The Contractor is to keep shutdowns of existing buildings to a minimum by scheduling the work and providing the required number of personnel to keep the shutdown to a minimum. This Contractor is to include for as many multiple teams of electricians is feasible to keep the shutdown work to the minimum.
- 1.27. PRE-PURCHASED EQUIPMENT
- 1.27.1. The Electrical Trade shall assume complete responsibility for the Owner's pre-purchased equipment and its associated equipment as if it had been purchased by the Contractor, with the single exception of payment.
- 1.27.2. The Electrical Trade shall provide a warranty for all pre-purchased equipment during the warranty period and shall include for all labour, material and shipping charges not covered in the manufacturer's warranty to completely repair or replace any defective pre-purchased equipment at no cost to the Owner during the warranty period.
- 1.27.3. The Electrical Trade shall take complete responsibility for the co-ordination of delivery of the separate items of equipment and their proper placement as required by jobsite conditions.
- 1.27.4. The Electrical Trade shall provide all materials and labour required to incorporate pre-purchased equipment into a working system whether or not shown on the drawings or specified herein.
- 1.27.5. The following list of equipment is pre-purchased:  
.1
- 1.28. PRE-TENDERED EQUIPMENT
- 1.28.1. The Electrical Trade shall assume complete responsibility for the Owner's pre-tendered equipment and its associated equipment as if it had been purchased by the Contractor, including payment.
- 1.28.2. The Electrical Trade shall provide a warranty for all pre-tendered equipment during the warranty period and shall include for all labour, material and shipping charges not covered in the manufacturer's warranty to completely repair or replace any defective pre-tendered equipment at no cost to the Owner during the warranty period.
- 1.28.3. The Electrical Trade shall take complete responsibility for the co-ordination of delivery of the separate items of equipment and their proper placement as required by jobsite conditions.
- 1.28.4. The Electrical Trade shall provide all materials and labour required to incorporate pre-tendered equipment into a working system whether or not shown on the drawings or specified herein.
- 1.28.5. The following list of equipment is pre-tendered:  
.1



1.29. VALUATION OF CHANGES

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

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

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

- .1 Quantity of each material.
- .2 Unit cost of each material.
- .3 Time involved.
- .4 Sub-trade quotations including a complete analysis of costs.
- .5 Mark-ups, if applicable.
- .6 Value of GST or HST, as applicable.
- .7 Proposed change in Contract Time.

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

1.29.3. The following shall not be included in the cost of the work but are covered by the allowance (mark-ups) for overhead and profit:

- .1 The Contractor's head office and site office expenses, including stationary, postage and other office supplies.
- .2 The costs of the Contractor's Project Manager, clerical and administrative personnel, and executive personnel.
- .3 Use of temporary offices, sheds, small tools, etc., including the cost of telephone, light, power, water and heat used therein,
- .4 Transportation and overnight room expenses for out of town labour, if local labour is unavailable.
- .5 Insurance premiums.
- .6 Licenses and permits, except when these are special for a particular item of work.
- .7 Printing charges for Proposed Changes, Change Orders and Drawings for Contractor's and Subcontractors' use in the work. Engineer's Representative will provide a PDF electronic copy of change notice documentation.
- .8 The cost of record, layout and working drawings and shop drawings.
- .9 The cost of clean-up and disposal of waste material.
- .10 Parking.

1.29.4. The Contractor shall not be entitled to any additional compensation arising out of changes to the Work other than the amounts determined and agreed to under CCDC2-2008 GC 6.2.

1.29.5. In computing accounts for extras and credits for any Proposed Change, all credits shall be deducted from the total sum of the extras before mark-ups or charges for overhead and profit are added.

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

requirements of the Contract Documents. Provide Owner immediately with any revised bonds or insurances.

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

- 1.29.8. The maximum percentage fee for mark-ups shall be as stated in the tables below unless otherwise stated in the Division 0/1 specifications. If mark-ups are noted in the general front-end specifications (i.e. Div-0/1), those values shall supersede any of the values listed in the tables below.

1.29.9. Permitted Mark-Ups

- .1 The following maximum net overhead and profit mark-ups by Contractors will be permitted for extra work under Change Order or Change Directive:

Cost of Extra Work, not including GST or HST, as applicable	Contractor's Mark-Up on Work of Own Forces (%)	Contractor's Mark-Up on Subcontracted Work (%)
\$0 to \$5,000	10	7
>\$5,000 to \$10,000	10	7
>\$10,000 to \$50,000	7	5
>\$50,000	5	4

- .2 The following maximum net overhead and profit mark-ups by Subcontractors will be permitted for extra work:

Cost of Extra Work, not including GST or HST, as applicable	Contractor's Mark-Up on Work of Own Forces (%)	Contractor's Mark-Up on Subcontracted Work (%)
\$0 to \$5,000	10	7
>\$5,000 to \$10,000	10	7
>\$10,000 to \$50,000	7	5
>\$50,000	5	4

- .3 Where a proposed change order includes both credits and extras, overhead and profit mark-ups apply to the net extra or credits, if any, of the entire change.

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

1.29.11. Labour Rate

- .1 During the duration of the electrical contract, extra work hourly labour units are to be based on the latest edition of the National Electrical Contractors Association (NECA) labour units column 1(one). No additional factors will be accepted.
- .2 The hourly labour rate for all changes will be based on a Journeyman Electrician rate as listed on the Electrical Supplementary Bid Form. The Owner and/or Engineer's Representative reserve the right to renegotiate the labour rate. The hourly labour rate will be exclusive of overhead and profit. The labour rate will be inclusive of all labour burden charges including: payroll and administrative burdens, all government payroll burdens, variable labour factors and union or association funds. The following labour

burdens are not part of the hourly labour cost and are covered under overhead and mark-up or under the NECA labour unit rates: all supervision, hand tools, warranties, storage, rentals, parking, clean-up, additional bonding, as-built drawings, material sorting/handling/hoisting, project financing, coffee break/rest periods, safety training including safety talks, WHMIS and the health and safety committee, non-productivity time and site office and consumables.

- .3 At the request of the Owner or the Engineer's Representative, the Contractor is to submit a detailed labour cost breakdown showing a breakdown of all adders to the base wage rate to show how the Contractor has come to the proposed hourly rate. The Owner and the Engineer's Representative reserve the right to negotiate the hourly labour rate with the Contractor.
- 1.29.12. When pricing additional work for Proposed Changes, the Electrical Contractor shall only price new materials that are required for the Proposed Change. Where existing materials and/or infrastructure (i.e. homerun conduits back to electrical panels) can be re-used for the Proposed Change, the Electrical Contractor shall utilize these items in the valuation of the Change at no extra cost.

## PROPOSED CHANGE ORDER

Company Name:	CCN #
Address:	Date:
City, Prov.:	Project Name:
Postal Code:	Project Number:
	Page Number:
Telephone:	Change Order #:
Fax:	
E-Mail address:	
Client Address:	

### Work Description

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

### Itemized Breakdown

<u>Description</u>	<u>Qty</u>	<u>Net Price U</u>	<u>Total Mat(\$)</u>	<u>Labor U</u>	<u>Total Hours</u>
¾' EMT		150.39 C		5.00 C	
¾' EMT STL SS CONN		65.97 C		10.00C	
¾' EMT STL SS CPLG		70.60 C		5.00 C	
¾' EMT STRAO 1-H		11.24 C		4.00 C	
#8 TO 10 x 7/8" PLAS ANCHOR		6.05 C		5.00 C	
(3/16)					
#10 x 1" SELF TAPPING SCREW		5.50 C		5.5 0 C	
<b>TOTALS</b>					

### Summary

<u>Description</u>	<u>Total Hours</u>
General Materials	
Material Tax (@ 15.000 %)	
<b>Material Total</b>	
JOURNEYMAN (xx Hrs. @ \$xx.00)	
Subtotal	
<b>OVERHEAD AND MARK-UP</b>	
Overhead/Mark-up (@ 10.000 %)	
Subtotal	
<b>Final Amount</b>	

- 1.30.1. The demolition drawings show the general scope of the demolition and not exact details or total extent. For exact details and total extent each service must be carefully checked on site. Before removing services follow the service through to ensure other areas of the building are not affected.
  - 1.30.2. Whenever existing services or equipment are to be removed, all electrical connections for such services shall be removed and securely terminated in an approved manner. If necessary to facilitate installation of new work, any existing services and equipment shall be removed and then replaced by this division.
  - 1.30.3. Whenever it becomes necessary to relocate any electrical services equipment to make possible installation of the work under this contract, such relocation shall be done by this division without additional cost to the Owner.
  - 1.30.4. Make safe and disconnect all power and systems, as and when, and to the extent required to facilitate the demolition.
  - 1.30.5. Ensure that all electrical, life safety services, and services for existing equipment, in areas outside the areas of this work, that are required to remain in service, shall do so.
  - 1.30.6. Relocate any electrical feeders or equipment that are required to remain in service, that are secured to existing walls, floors or ceilings to be demolished or that are buried and required to be excavated for new work.
  - 1.30.7. Remove and replace any electrical equipment on walls or ceilings that will be demolished and rebuilt.
  - 1.30.8. Disconnect and remove existing light fixtures, devices, outlets, CCTV, security devices, etc. which are not to be reused. Such items shall be packaged and turned over to the Owner at a place designated by the Owner. Cut back and cap unused raceway and outlets and remove unused wiring back to panelboard in an approved manner.
  - 1.30.9. Ensure that all existing equipment which is to be reused and/or relocated is thoroughly reviewed and refurbished to ensure correct operation when put back into service and to meet the requirements of the local authorities having jurisdiction. All existing electrical equipment which is no longer required shall be removed and disposed of off-site.
  - 1.30.10. Carry out the work with a minimum of noise, dust and disturbance.
  - 1.30.11. Provide tools and clean up equipment. Obtain the Owner's permission for the use of electrical, plumbing or drainage outlets.
  - 1.30.12. Where a device is shown to be relocated on the drawings, contractor to remove and re-install device and back box and re-feed the device with new conduit and wire from the nearest existing accessible junction box.
  - 1.30.13. Electrical Contractor is responsible for the patching and re-painting the entire wall where a device and/or box has been added, removed or relocated.
  2. Products
  - 2.1. NOT USED
  3. Execution
  - 3.1. NOT USED
- END OF SECTION

1. General

1.1. WORK INCLUDED

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

2. Products

2.1. RECORD DRAWINGS

2.1.1. The Electrical Contractor shall request in writing from the Engineer's Representative all electrical AutoCAD drawings. Contractor to complete attached form and pay the Engineer's Representative directly the costs identified within the form prior to receiving the drawings. After the final as-built drawings have been reviewed, provide multiple copies of the drawings on CD or DVD or USB stick. One copy is to be returned to the Engineer's Representative for their records and a minimum of one copy with each set of maintenance manuals. Provide additional copies if required under the General Conditions. The Contractor is to use latest release of AutoCAD software, and provide electronic files saved in a version acceptable to the end user and engineer.

2.1.2. The contractor to identify the cost of Record Drawings and the Operation and Maintenance Manuals as a separate line item on their progress draw. The following values are to be broken out:

\$5,000	For Electrical Contracts up to \$250,000
2% of Electrical Contract	For Electrical Contracts from \$250,000 to \$1,500,000
\$30,000	For Electrical Contracts over \$1,500,000

The project will remain incomplete and no money will be released until the final versions, both hard and electronic, of the drawings and manuals are received.

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

2.1.4. Final as-built drawings to include all revisions made to the drawings during construction, including all approved changes. The as-built drawings are to also include the routing of all feeders except for branch circuits, all junction boxes to be shown, drawing legend to be updated to include all symbols and lines used to show as-built conditions, quantity of wires in each conduit, and circuit numbers of wires in each conduit. Include slab layout drawings in as-built drawing package.

2.1.5. CADD Requirements.

- .1 A complete list of layer names and brief description of each layer's use shall accompany all files.
- .2 Fonts for text shall be AutoCAD standard. Custom fonts, shape files, etc., are not to be used.
- .3 Final as-built drawings shall be returned on CD ROM or DVD or USB stick.
- .4 Each CD ROM or DVD or USB stick shall be clearly labelled with Engineer's Representative and Owner, Contract number, file names and Drawing number. If a complete listing exceeds the label size provide a "readme.txt" file in ASCII format with each CD ROM or DVD or USB stick. A printed copy of the readme file shall accompany each CD ROM or DVD or USB stick.
- .5 All drawings shall be in the same units as issued on Bid Documents.

- .6 Provide a complete list of symbol (block) names with a description of each symbol.
- .7 Special effort shall be made to ensure that drafting is accurate: i.e. appropriate lines are indeed horizontal and vertical; lines that should intersect do but not over-intersect and ensure that entities are placed on correct layers.
- 2.1.6. The Electrical Contractor will maintain two sets of white prints on site on which the Electrical Contractor shall clearly mark, as the job progresses, all changes and deviations from that shown on Contract Drawings. After review and approval of service lines in trenches, the Electrical Contractor shall take 'as-built' measurements, including all depths, prior to commencement of backfilling operations. The location of buried electrical ducts and conductors shall be shown on the drawings and dimensioned from fixed points. Drawings shall be kept up-to-date during construction and in addition to field measurements shall include variation orders, field instructions and all other changes.
- 2.1.7. On completion of the building, the Electrical Contractor shall forward to the Engineer's Representative the two sets of final drawings indicating all such changes and deviations for review by the Engineer's Representative. Each set shall include full size hard copy of the drawings, and electronic copy of the drawings on CD ROM or DVD or USB stick.
- 2.1.8. The Electrical Contractor may request from the Engineer's Representative the most current electrical drawings in AutoCAD, IBM PC DVD format (at a nominal charge of \$500.00).
- 2.1.9. The AutoCAD as-built documents shall meet all the Owner's and Engineer's Representative's requirements.
- 3. Execution
- 3.1. NOT USED

END OF SECTION

PROJECT NAME: Xxx

ATTENTION: Xxx

PROJECT NO.: Xxx

DATE: YYYY-MM-DD

ISSUED BY: Xxx

### Conditions for Limited Use of CAD Drawings

Authorization for limited use of the Computer-Aided Drafting (CAD) drawing files listed below is hereby granted, subject to the following conditions. Signing of this form constitutes acceptance and agreement with the conditions and limitations.

Copyright is reserved. The drawing and design contained in the CAD drawing file is at all times the exclusive property of the Architect/Engineer and shall not be used without the Architect/Engineer's written consent.

The CAD drawing file may not be used wholly or in part for any purpose other than the intended use as stated on this form. Copying or distribution of this CAD drawing file in whole or in part to parties other than those signing below is not allowed.

The CAD file represents drawings which were prepared primarily for the purpose of obtaining tender prices. The drawings may or may not incorporate subsequent revisions, change orders, or addenda which have modified the drawings. CAD files obtained from different disciplines may not be fully updated and coordinated with other disciplines and must be verified from the tender documents. The Architect/Engineer assumes no liability for errors or omissions in the CAD drawing files. Authorized user assumes all risk and expense associated with the use of the drawing files in the production of his work.

References to the Architect and Engineer must be deleted from the drawings.

Please indicate a P.O. Number for charges associated with administrative costs to provide requested AutoCAD drawings.

Our charges are as follows:	\$50.00 each for the first 5 drawings			
	\$20.00 for each additional drawing from 6 to 19			
	\$500.00 for 20 drawings or more			
List of requested drawings:				
Total No. of Drawings:		Total Charge:		+ GST or HST, as applicable

Intended use (Shop drawings, As-built drawings, Installation and Interference drawings, etc.)

CD ROM or DVD or USB stick (please provide delivery address)

E-mail (please provide e-mail address)

A cheque in the above amount shall be payable to **Smith + Andersen**.

Please sign and fax back this form to Smith + Andersen (416-487-9104) acknowledging the above charges and Conditions for Limited Use of CAD Drawings.

Accepted by:

Signature

Name (print or type)

Company Name

P.O. #

Company Address

Phone #

c.c. Accounting - V.Mugabi; (Project Principal) – Smith + Andersen



1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
  - 1.2. RELATED WORK
    - 1.2.1. Comply with Div. 00 for submittal requirements and as amended below.
2. Products
  - 2.1. SHOP DRAWINGS
    - 2.1.1. Submittals/Shop Drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each Shop Drawing shall give the identifying number of the specific assembly for which it was prepared (e.g. SWBD-1A).
    - 2.1.2. Each Shop Drawing for non-catalogue items shall be prepared specifically for this project. Shop Drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.
3. Execution
  - 3.1. SUBMISSION
    - 3.1.1. Each Shop Drawing or catalogue sheet shall be stamped and signed by the Contractor to indicate that they have checked the drawing for conformance with all requirements of the drawings and specifications, that they have co-ordinated this equipment with other equipment to which it is attached and/or connected and that they have verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the work of other trades. Ensure that electrical co-ordination is complete before submitting drawings for review.
    - 3.1.2. Contractor to submit all submittals/shop drawings electronically in PDF format. Submittal to come complete with a transmittal bound to the PDF file with the transmittal identifying the total number of pages in the submittal including the transmittal page. For any submittal with pages larger than 11x17, the Contractor is to submit a minimum of 3 hard copies unless additional copies are identified in the contract documents.
    - 3.1.3. Equipment shall not be released for manufacture until the shop drawing has been reviewed by Engineer's Representative. Contractor shall assume responsibility and cost for field changes. Installation of any equipment shall not start until after final review of Shop Drawings by the Engineer's Representative has been obtained.
    - 3.1.4. When requested, Shop Drawings shall be supplemented by data explaining the theory of operation - for example: fire alarm controller - the Engineer's Representative may also request that this information be added to the maintenance and operating manual.
    - 3.1.5. Provide space for Shop Drawing review stamps for the Contractor and Engineer's Representative. This space shall be clear of all technical information and shall not be on the back of any sheets.

- 3.1.6. One original Shop Drawing will be returned either hard copy or electronically. All copies required for the trades, suppliers or other Engineer's Representatives will be copied or printed by the Contractor.
- 3.1.7. As part of the electrical Engineer's Representative's scope of the work, shop drawings shall be reviewed no more than twice. Should three or more reviews be required due to reasons of Contractor omissions causing resubmission requests, the Contractor shall reimburse the electrical Engineer's Representative for time expended in these extra reviews.

END OF SECTION

1. General
- 1.1. WORK INCLUDED
- 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
2. Products
- 2.1. MOUNTING HEIGHTS
- 2.1.1. Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- 2.1.2. If mounting height of equipment is not specified or indicated, verify with the Consultant before proceeding with installation.
- 2.1.3. Unless indicated otherwise on the drawings or within the specifications, install electrical equipment at following heights.
  - .1 Local switches: 1050 mm.
  - .2 Wall receptacles:
    - .1 General: 450 mm.
    - .2 Above top of continuous baseboard heater: 200 mm.
    - .3 Above top of counters or counter splash backs: 175 mm.
    - .4 In mechanical rooms: 1200 mm.
    - .5 In equipment storage rooms: 900mm.
  - .3 Panelboards: 2000 mm to top of panel.
  - .4 Telephone and interphone outlets: 450 mm.
  - .5 Wall mounted telephone and interphone outlets: 1050 mm.
  - .6 Fire alarm stations: 1200 mm.
  - .7 Wall Mounted Fire alarm audible devices: 2300 mm.
  - .8 Television outlets not mounted behind a wall mounted television: 450 mm.
  - .9 Wall mounted speakers: 2100 mm.
  - .10 Clocks: 2100 mm.
  - .11 Handicap pushbuttons: 1050 mm.
  - .12 Wall mounted Exit Signs
    - .1 For 2400 mm to 2500 mm ceiling heights: 2100 mm.
    - .2 For all ceilings heights greater than 2500 mm: 2400 mm.
  - .13 Wall mounted Battery Packs and Emergency Heads
    - .1 For 2400 mm to 2500 mm ceiling heights: 2100 mm.
    - .2 For all ceilings heights greater than 2500 mm: 2400 mm.
  - .14 Wall mounted occupancy sensors: 1050 mm.
  - .15 Wall mounted visible signal devices: entire lens shall be no less than 2000 mm and no more than 2400 mm.

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

3. Execution

3.1. NOT USED

END OF SECTION

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
    - 1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
  - 1.2. REFERENCES
    - 1.2.1. CSA C22.2 No.0.3, Test Methods for Electrical Wires and Cables, latest edition.
    - 1.2.2. CSA C22.2 No. 38, Thermoset-Insulated Wires and Cables, latest edition.
    - 1.2.3. CSA-C22.2 No. 51, Armoured Cables, latest edition.
    - 1.2.4. CSA C22.2 No. 75, Thermoplastic-Insulated Wires and Cables, latest edition.
    - 1.2.5. CSA-C22.2 No. 96, Portable Power Cables, latest edition.
    - 1.2.6. CSA-C22.2 No. 123, Metal Sheathed Cables, latest edition.
    - 1.2.7. CSA-C22.2 No. 124, Mineral-Insulated Cable, latest edition.
    - 1.2.8. CSA-C22.2 No. 131, Type TECK 90 Cable, latest edition.
    - 1.2.9. CSA-C22.2 No. 174, Cables and Cable Glands for Use in Hazardous Locations, latest edition.
    - 1.2.10. CAN/ULC S139, Standard Method of Fire Test for Evaluation of Integrity of Electrical Power, Data, and Optical Fibre Cables, latest edition.
    - 1.2.11. UL 2196, Standard for Tests for Fire Resistive Cables, latest edition.
    - 1.2.12. ASTM B800 - Standard Specification for 8000 Series Aluminium Alloy Wire for Electrical Purposes-Annealed and Intermediate Tempers, latest edition.
  - 1.3. SHOP DRAWINGS AND PRODUCT DATA
    - 1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
2. Products
  - 2.1. BUILDING WIRES
    - 2.1.1. Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
    - 2.1.2. Contractor to provide copper conductors on conductors sizes up to and including #8 AWG. Contractor to provide copper conductors for sizes larger than #8 AWG unless identified as aluminium or NUAL on the drawings.
    - 2.1.3. All conductors to have size as indicated, with insulation of chemically cross-linked thermosetting polyethylene material rated RW90 or RWU90 to CSA-C22.2 No.38 or heat and moisture-resistant thermoplastic polyvinyl chloride (PVC) insulation with an outer nylon jacket rated T90 to CSA-C22.2 No.75 rated as follows:
      - .1 Insulation rated at 1000V for 600V systems that are ungrounded or have a neutral grounding resistor to limit ground fault current
      - .2 Insulation rated at 600V for the other 600V and 347/600V distribution systems not covered under item #1 above.

- .3 Insulation rated at 600V for all systems rated at 480V and less.
- 2.1.4. All aluminium or NUAL conductors to be an aluminium alloy with CSA certified as an Aluminium conductor material (ACM) and meet the requirements of the Aluminium Association Inc. AA8030 and ASTM B800 standards. Provide an anti-oxidant compound, Ideal NOALOX, on all aluminum conductor terminations.
- 2.1.5. RWU-90 wiring is to be used for underground installations.
- 2.2. TECK CABLE
  - 2.2.1. Cables to CSA-C22.2 No.131.
  - 2.2.2. Conductors:
    - .1 Bonding conductor: copper.
    - .2 Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.
  - 2.2.3. Insulation:
    - .1 Chemically cross-linked thermosetting polyethylene type RW90, rated 1000 V.
  - 2.2.4. Inner jacket: polyvinyl chloride material.
  - 2.2.5. Armour: interlocking aluminum.
  - 2.2.6. Overall covering: thermoplastic polyvinyl chloride material rated at a minimum of FT-4. Provide FT-6 jacket when TECK cables are run in return air plenum.
- 2.3. VARIABLE FREQUENCY DRIVE CABLES
  - 2.3.1. Variable frequency drives are also known as variable speed drives.
  - 2.3.2. Cables to CSA-C22.2 No. 123 and CSA-C22.2 No. 174.
  - 2.3.3. Conductors:
    - .1 Three (3) bare bonding conductor coppers sized to Table #16 of the Electrical Code.
    - .2 Circuit conductors: copper, size as indicated.
  - 2.3.4. Insulation:
    - .1 Chemically cross-linked thermosetting polyethylene type RW90, rated 1000 V.
  - 2.3.5. Inner jacket: polyvinyl chloride material.
  - 2.3.6. Armour: interlocking aluminum.
  - 2.3.7. Overall covering: thermoplastic polyvinyl chloride (PVC) material rated at a minimum of FT-4.
- 2.4. MINERAL-INSULATED CABLES
  - 2.4.1. Where two (2) hour fire rating is indicated on the drawings, provide Mineral-Insulated cables.
  - 2.4.2. Conductors: solid bare soft-annealed copper, size as indicated.
  - 2.4.3. Insulation: compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable.
  - 2.4.4. Overall covering: annealed seamless copper sheath, Type M1 rated 600 V, 250 C.
  - 2.4.5. Outer jacket: PVC applied over sheath.
  - 2.4.6. Two (2) hour fire rating.
  - 2.4.7. Conform to requirements of CSA-C22.2 No. 124; and ULC S 139.

- 2.4.8. All mineral-insulated cable larger than #6 AWG shall be single conductor. For conductors #6AWG and smaller, multi-conductor mineral-insulated cable is acceptable.
- 2.5. FIRE RATED MC CABLE
  - 2.5.1. Conductors: stranded annealed copper, size as indicated.
  - 2.5.2. Insulation: low smoke silicon rubber.
  - 2.5.3. Armour: continuously welded and corrugated copper sheath,
  - 2.5.4. Outer Jacket: Black low smoke, zero halogen polyolefin, FT4 rated
  - 2.5.5. Two hour fire rating.
  - 2.5.6. Conform to requirements of CSA-C22.2 No. 123; UL 2196 and ULC S 139 with hose stream.
- 2.6. ARMOURED CABLES
  - 2.6.1. Cables to: CSA-C22.2 No. 51.
  - 2.6.2. Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.
  - 2.6.3. Type: AC90 (BX).
  - 2.6.4. Armour: interlocking type fabricated from aluminium strip.
  - 2.6.5. Type: ACWU90 - PVC flame retardant jacket over armour meeting requirements of Vertical Tray Fire Test of CSA-C22.2 No.0.3 with maximum flame travel of 1.2 m.
- 2.7. ALUMINUM SHEATHED CABLE
  - 2.7.1. Circuit conductors: copper, size as indicated unless aluminium or NUAL is identified on the drawings. Aluminium or NUAL conductor to be provided as per item 2.1.4.
  - 2.7.2. Insulation: type RA90 rated 1000 V.
  - 2.7.3. Sheath: aluminium applied to form continuous corrugated seamless sheath.
  - 2.7.4. Outer jacket of PVC applied over sheath for direct burial or wet locations.
- 2.8. DIESEL LOCOMOTIVE CABLES (DLO)
  - 2.8.1. Cable: to CSA-C22.2 No. 96 Portable Power Cables, rated to 2000V.
  - 2.8.2. Conductor: stranded tinned annealed copper, size and number as indicated
  - 2.8.3. Separator: Paper or polyester tape separates the conductor from the rubber insulation to aid in stripping.
  - 2.8.4. Insulation: premium grade Ethylene Propylene Rubber (EPR), rated 90 deg. C.
  - 2.8.5. Jacket: Black, heavy duty chlorinated polyethylene (CPE), sunlight resistant, rated at a minimum of FT-4.
- 2.9. WIRING TERMINATION
  - 2.9.1. Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.
  - 2.9.2. Lugs, terminals, screws used for termination of multiple wires must be rated for their intended use.

3. Execution

3.1. GENERAL

- 3.1.1. Provide a minimum of one bonding conductor for each three ungrounded conductors on all conduit and cable runs. Size bonding conductor to applicable tables of the Canadian Electrical Code. Provide separate bonding conductors for each ground fault circuit interrupter circuits. All bonding conductors to be copper and insulated with a green coloured insulation.
- 3.1.2. All equipment, junction boxes, pull boxes, liquid tight flex, etc. to be bonded to ground through bonding conductors.
- 3.1.3. Provide separate neutral conductor for each 120 volt circuit for all circuits feeding receptacles and power outlets.
- 3.1.4. Provide a variable frequency drive (VFD) cable from each VFD unit to each motor. Wiring to be installed in accordance with the VFD and motor manufacturer instructions.
- 3.1.5. All cable terminations to be compression type fittings for wire sizes greater than #8 AWG. All compression type fittings to be two-hole long barrel type with inspection / viewing window. Where mechanical screw type lugs are allowed by the Engineer's Representative, they will be suitable for quantity of parallel runs of wire that are to be terminated under.
- 3.1.6. Armoured Cable Type AC90 (BX) may only be used for individual drops from slab mounted junction box to recessed mounted light fixtures or where noted on the drawings where wiring is required to be installed within an existing wall. The maximum allowable distance of armoured cable is 3m. Contractor to receive written approval from the Engineer's Representative to run armoured cable further than 3m from junction box. Daisy chaining of fixtures is only acceptable in dry wall ceilings. Wiring in conduit is to be brought to a junction box to allow for the transition to armoured cable. Armoured cable is not to be installed directly into electrical panels or run in walls for receptacles.
- 3.1.7. Branch circuit wiring to be upsized as follows to address voltage drop when:
  - .1 The entire length of the circuit wiring exceeds 25 m – branch wiring to be a minimum of No. 10 AWG.
  - .2 The entire length of the circuit wiring exceeds 40 m – branch wiring to be a minimum of No. 8 AWG.
  - .3 The entire length of the circuit wiring exceeds 60 m – branch wiring to be a minimum of No. 6 AWG.
- 3.1.8. Wire Splicing
  - .1 Splice up to and including No. 6 AWG with nylon insulated expandable spring type connectors.
  - .2 Splice larger conductors using compression type connectors wrapped in PVC insulation rated at the respective voltage.

3.2. INSTALLATION OF BUILDING WIRES

- 3.2.1. Install all building wiring in conduit unless otherwise noted. Conduit to be sized to the electrical code unless noted on the drawings or in the specifications.
- 3.2.2. All conductors are to be colour coded. Provide colour tape at all terminations to identify all conductors in each run.

3.3. INSTALLATION OF TECK90 CABLE, VARIABLE FREQUENCY DRIVE CABLE, ARMOURED CABLE OR ALUMINUM SHEATHED CABLE

- 3.3.1. Group cables wherever possible on channels.



- 3.3.2. Terminate cables in accordance with manufacturer's instructions.
- 3.3.3. Fastenings:
  - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
  - .2 Channel type supports for two or more cables.
  - .3 Galvanized threaded rods: 6 mm dia. minimum to support suspended channels.
- 3.3.4. Connectors:
  - .1 Watertight, approved for respective cables.
- 3.3.5. For single conductor cables, ground the sheath at the upstream (source) panel and provide insulated fibre plate at the load end, so as to prevent circulating sheath currents.
- 3.4. INSTALLATION OF MINERAL-INSULATED AND FIRE RATED MC CABLES
- 3.4.1. Handling:
  - .1 Cable shall be uncoiled by rolling or rotating supply reel. Do not pull from coil periphery or centre.
- 3.4.2. Bending:
  - .1 Not less than six (6) times the cable diameter for cable not more than 250 kcmil.
  - .2 Not less than twelve (12) times the cable diameter for cable diameter for cable more than 350 and 500 kcmil.
- 3.4.3. Splicing:
  - .1 All fire rated splices shall be made in the factory. In the event of a field splice is necessary, it must be made in the field by manufacturer's field technician.
- 3.4.4. Terminations:
  - .1 Field made terminations shall be made with cable manufacturer's termination kits only. Stripping tools, crimping and compression tools available from the manufacturer shall be used for proper cable termination.
  - .2 Connections to ferrous cabinets for single conductor cables shall incorporate brass plates. Installed per manufacturer's drawing.
  - .3 At cable terminations use thermoplastic sleeving over bare conductors.
- 3.4.5. Sheath induction reduction:
  - .1 When multi-phase circuits have paralleled single conductors, cables shall be run in groups having one of each phase in each group.
  - .2 Each set of paralleled conductors shall be separated by at least two single cable diameters.
- 3.4.6. Exposed or Surface Installations:
  - .1 Cable shall be secured directly to fire rated building structure using:
    - .1 Straps: 13 mm wide x 38 mm long by 0.75 mm thick stainless steel or copper straps. Each strap shall contain two 5 mm holes for securing with 5 mm by minimum 44 mm long steel anchors.
  - .2 Support 2 hr fire rated cables at 1 m intervals.
- 3.4.7. Wall or floor penetrations:
  - .1 Provide approved fire stopping of all penetrations.
  - .2 Neatly train and lace cable inside boxes, equipment, and panelboards.

- .3 Where cables are buried in cast concrete or masonry, sleeve for entry of cables.
- .4 When penetrating a fire rated wall or fire rated floor, the cable must extend a minimum of 305mm beyond the fire rated wall or fire rated floor. The 305mm dimension can be in any direction as 305mm of cable length is required to allow for proper heat dissipation such that cable terminations do not overheat.

3.5. FIELD QUALITY CONTROL

- 3.5.1. Prior to energizing wires/cables, measure insulation resistance of each wire/cable. Ensure readings are acceptable per installation recommendations. Tabulate and submit for approval as a submittal.
- 3.5.2. All Wires and Cables to be tested on site as defined in Section 26 08 01.00 – TECHNICAL SERVICES DIVISION START-UP SERVICE and herein. Contractor to oversee all testing and correct any deficiencies noted.

3.6. INSTALLATION OF CONTROL CABLES

- 3.6.1. Install control cables in conduit.
- 3.6.2. Ground control cable shield.

END OF SECTION

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Section 26 00 05.00 – REGIONAL SUPPLEMENTAL REQUIREMENTS.
    - 1.1.2. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
    - 1.1.3. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
  - 1.2. REFERENCES
    - 1.2.1. CSA C22.2 No. 41– Grounding and Bonding of Equipment, latest edition.
    - 1.2.2. CSA C22.1 – Canadian Electrical Code, Part 1, latest edition.
    - 1.2.3. IEEE Standard 81 – IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System, latest edition.
  - 1.3. DESCRIPTION
    - 1.3.1. Provide system grounding to meet requirements of current applicable codes.
  - 1.4. SHOP DRAWINGS AND PRODUCT DATA
    - 1.4.1. Submit shop drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
    - 1.4.2. Submit shop drawings for ground bars and ground rod inspection wells for engineer's review prior to manufacture.
    - 1.4.3. Submit main system ground test report as a shop drawing for engineer's review. Include final reviewed report in the project O&M manuals.
2. Products
  - 2.1. GROUNDING & BONDING EQUIPMENT
    - 2.1.1. Meet standard of CSA C22.2 No. 41 – Grounding and Bonding of Equipment, latest edition.
  - 2.2. CONDUCTORS
    - 2.2.1. Bare or insulated, stranded, soft drawn annealed copper wire, for: ground bus, electrode interconnections, metal structures, ground connections, telephone ground.
  - 2.3. LUGS
    - 2.3.1. All grounding connections to be made with compression type fittings and lugs with inspection / viewing window.
3. Execution
  - 3.1. INSTALLATION

- 3.1.1. Install complete permanent, continuous, system and circuit, equipment, grounding and bonding systems including, conductors, connectors, and accessories, as indicated, to conform to requirements of local authority having jurisdiction over installation.
- 3.1.2. Provide main station ground grid as shown on drawing but the ground grid shall consist of a minimum of four (4) driven ground rods. Copper ground rods shall be not less than 3 m long and 19 mm in diameter and where practicable located adjacent to the equipment to be grounded (i.e. main electrical room). Interconnect all ground rods underground with a #2/0 AWG bare ground conductor.
  - .1 If main ground grid cannot be installed directly below the main electrical room, then provide a remote ground grid by installing the ground rods at the lowest floor level of the building and provide two grounding conductors of a minimum of #4/0 AWG copper to connect the ground grid to the main electrical room equipment. Run the two conductors through separate routes separated by a minimum of 5 m.
- 3.1.3. Supply and install a new ground bus system consisting of a length of copper bus, 25 mm thick ebony pad with chamfered edges as shown on the drawings. A minimum of two 1200 mm ground bars are to be provided in transformer vault(s), main electrical room(s) and generator room(s). Where a perimeter ground bus is shown on the drawings, supply and install a 50 mm x 6 mm copper bus on all walls attached at 1.5 m intervals on 13 mm standoffs. The perimeter ground bus shall be continuous around the room and shall be continued above or below all openings such as doors and vents.
- 3.1.4. Interconnect the ground bars to the ground grid with a minimum #2/0 AWG bare copper ground conductor if the ground grid is adjacent to the main electrical room(s). Where the ground grid is remote, connect the ground bars to the remote ground grid as described in 3.1.2.(1) above
- 3.1.5. Supply and install inspection box for each ground rod. Inspection box is to be suitable for installation in heavy traffic areas and is to come complete with a lockable lid and security key.
- 3.1.6. Connect to the ground bus all metal equipment enclosures, as well as all other metal parts such as mechanical pipes, ducts, waste lines, door frames, railings, grilles, fences, etc. with minimum #2/0 AWG bare copper conductors.
- 3.1.7. For solidly grounded systems, transformer neutrals, switchboard neutrals and all similar bonding connections, the bonding conductors shall be sized in accordance with Table 16 of the Electrical Code.
- 3.1.8. Provide cable grips to receive all grounding conductors. Identify all grounding conductors at the ground pad using lamacoid nameplates. Ground bus system to be provided in rooms as shown.
- 3.1.9. Terminate the following conductors at the ground bus system:
  - Service neutral -as indicated on drawings
  - Telecommunications ground -as per EIA/TIA standard 607-A (latest edition)

TBB/GE linear length m (ft)	TBB/GE size (AWG)
less than 4 (13)	6
4 – 6 (14 – 20)	4
6 – 8 (21 – 26)	3
8 – 10 (27 – 33)	2
10 – 13 (34 – 41)	1
13 – 16 (42 – 52)	1/0
16 – 20 (53 – 66)	2/0
20 – 26 (67 – 84)	3/0
26 – 32 (85 – 105)	4/0
32 – 38 (106 – 125)	250 kcmil
38 – 46 (126 – 150)	300 kcmil
46 – 53 (151 – 175)	350 kcmil
53 – 76 (176 – 250)	500 kcmil
76 – 91 (251 – 300)	600 kcmil
Greater than 91 (301)	750 kcmil

where,

TBB = Telecommunications Bonding Backbone

- Main system ground -#2/0 AWG or 2 x # 4/0 AWG for remote ground grids
- Bonding conductor -as per Table 16 of CSA C22.1

- 3.1.10. Ground all metallic water, gas, and waste systems with a minimum #2/0 AWG copper in accordance with code requirements.
- 3.1.11. Install bonding connections to typical equipment included in, but not necessarily limited to, following list: frames of motors, starters, control panels, building steel work, elevators, distribution panels and outdoor lighting.
- 3.1.12. Commission an approved certified testing Agency to perform a main system ground test. Submit the main system ground test report as a shop drawing for engineer's review. Provide a copy of the report in the maintenance manual. (Refer to Part 3.2).
- 3.1.13. Install connectors in accordance with manufacturer's instructions.
- 3.1.14. Ground rods to be interconnected by grounding grid conductors (sized as per sections above) and buried to a maximum depth of 600 mm below the rough station grade and a minimum depth of 150 mm below the finished station grade.
- 3.1.15. Protect exposed grounding conductors from mechanical injury.
- 3.1.16. Install bonding conductor for flexible conduit and connect at both ends to grounding bushing with solderless lug, clamp or cup washer and screw. Neatly cleat bonding conductor to exterior of flexible conduit.
- 3.1.17. Provide separate, insulated bonding conductor within each feeder and branch circuit raceway.
- 3.1.18. Interface with the lightning protection system, if one is installed for this building.
- 3.2. TESTING
  - 3.2.1. The contractor shall pay for the testing and verification of the entire building ground system using a certified testing Agency. Tests shall include main ground grid and ground rods, and grounding connections between all electrical and communication rooms. The agency shall provide complete test reports indicating test methodology and results. All costs shall be included in contract bid.
  - 3.2.2. Following are acceptable methods of testing the ground grid. Testing shall be in accordance with IEEE Standard 81 (latest edition).

- .1 Two-Point Method
- .2 Three-Point Method
- .3 Ratio Method
- .4 Staged Fault Tests
- .5 Fall-of-Potential Method

END OF SECTION

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
    - 1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
  - 1.2. SHOP DRAWINGS AND PRODUCT DATA
    - 1.2.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
    - 1.2.2. Conduit and equipment provided under the Electrical division shall be complete with all necessary supports and hangers required for a safe and workmanlike installation.
2. Products
  - 2.1. MATERIALS
    - 2.1.1. Provide “U” type support Strut as manufactured by Unistrut.
3. Execution
  - 3.1. INSTALLATION
    - 3.1.1. The Contractor to supply anchor bolts and base diagrams of equipment showing exact location for anchor bolts.
    - 3.1.2. It shall be the responsibility of the electrical division to supply the Contractor with anchor bolts and base diagrams of equipment showing exact location of anchor bolts.
    - 3.1.3. All drilling for hangers, rod inserts and work of similar nature shall be done by this Division.
    - 3.1.4. Auxiliary structural members shall be provided under the electrical section concerned where conduits or equipment must be suspended between the joists or beams of the structure, or where required to replace individual hanger to allow for installation on new services. Submit details for review as requested.
    - 3.1.5. Depending on type of structure, hangers shall be either clamped to steel beams or joists, or attached to approved concrete inserts.
    - 3.1.6. Approved type expansion shields and bolts may be used for conduit up to 100 mm diameter where the pre-setting of concrete inserts is not practical. Submit Shop Drawings.
    - 3.1.7. Suspension from metal deck shall not be allowed unless specifically accepted by the Engineer’s Representative. Drawings of the proposed method of suspension must be submitted for review.
    - 3.1.8. Hangers, hanger rods and inserts in all parking and ramp areas shall meet the requirements of CAN/CSA-S413 – Parking Structures (latest edition) and shall be of corrosion-resistant material or have an effective, durable corrosion resistant coating. Submit samples for approval.
    - 3.1.9. Suspending one hanger from another shall not be permitted.

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

3.2. HORIZONTAL RUNS ON THE ROOF

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

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

3.2.3. Wood Blocks are not acceptable.

END OF SECTION



1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Section 26 00 05.00 – REGIONAL SUPPLEMENTAL REQUIREMENTS.
    - 1.1.2. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
    - 1.1.3. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
    - 1.1.4. Section 26 05 53.00 – IDENTIFICATION.
    - 1.1.5. Section 26 05 63.00 – ACCESS DOORS AND ACCESSIBILITY.
  - 1.2. REFERENCE
    - 1.2.1. CSA 22.1 - Canadian Electrical Code - Part 1, latest edition.
  - 1.3. SHOP DRAWINGS AND PRODUCT DATA
    - 1.3.1. Submit shop drawings and product data for cabinets in accordance with specification Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
2. Products
  - 2.1. SPLITTERS
    - 2.1.1. Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position. Provide CSA Type 1 enclosures in non-sprinklered environments and CSA Type 4/12 in sprinklered environments.
    - 2.1.2. Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
    - 2.1.3. At least three spare terminals on each set of lugs in splitters less than 400 A.
  - 2.2. JUNCTION AND PULL BOXES
    - 2.2.1. Welded steel construction with screw-on flat covers for surface mounting.
    - 2.2.2. Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.
  - 2.3. CABINETS
    - 2.3.1. Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
    - 2.3.2. Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm plywood backboard for surface or flush mounting. The plywood backboard is to have a fire-resistant coating on the front. Do not paint over plywood fire rating certification stamp.
3. Execution
  - 3.1. SPLITTER INSTALLATION
    - 3.1.1. Install splitters and mount plumb, true and square to the building lines.

3.1.2. Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2. JUNCTION, PULL BOXES AND CABINETS INSTALLATION

3.2.1. Install pull boxes in inconspicuous but accessible locations.

3.2.2. Mount cabinets with top not higher than 2000 mm above finished floor.

3.2.3. Install terminal block as indicated in Type T cabinets.

3.2.4. Only main junction and pull boxes are indicated. Install pull boxes as follows:

- .1 A conduit run exceeds 30 m and;
- .2 360 degree of combined bends between pull boxes for power conduits or 180 degree of combined bends between pull boxes for communication and low voltage conduits.

3.3. IDENTIFICATION

3.3.1. Provide equipment identification in accordance with Section 26 05 53.00 – IDENTIFICATION.

3.3.2. Install identification labels indicating system name, voltage, and phase.

END OF SECTION

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Section 26 00 05.00 – REGIONAL SUPPLEMENTAL REQUIREMENTS.
    - 1.1.2. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
  - 1.2. REFERENCES
    - 1.2.1. CSA C22.1-Canadian Electrical Code, Part 1, latest edition.
    - 1.2.2. National Building Code of Canada, latest edition.
    - 1.2.3. CAN/ULC-S115, Fire Tests of Fire Stop Systems, latest edition.
2. Products
  - 2.1. OUTLET AND CONDUIT BOXES GENERAL
    - 2.1.1. Size boxes in accordance with the Electrical Code.
    - 2.1.2. Square or larger outlet boxes as required for special devices.
    - 2.1.3. Gang boxes where wiring devices are grouped.
    - 2.1.4. Blank cover plates for boxes without wiring devices.
    - 2.1.5. 347V outlet boxes for 347 V switching devices.
    - 2.1.6. Combination boxes with barriers where outlets for more than one system are grouped.
  - 2.2. SHEET STEEL OUTLET BOXES
    - 2.2.1. Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 75 mm x 50 mm x 38 mm or as indicated. 100 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
    - 2.2.2. Provide cast FS aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles connected to rigid conduit.
    - 2.2.3. Provide electro-galvanized steel utility boxes for surface mounted boxes connected to surface-mounted EMT conduit, minimum size 100 mm x 54 mm x 48 mm.
    - 2.2.4. Square or octagonal outlet boxes for lighting fixture outlets.
    - 2.2.5. Square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.
  - 2.3. MASONRY BOXES
    - 2.3.1. Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.
  - 2.4. CONCRETE BOXES
    - 2.4.1. Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5. FLOOR BOXES

- 2.5.1. Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brushed aluminum faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 28 mm for receptacles; 73 mm for communication equipment.
- 2.5.2. Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 12.7 mm and 19 mm conduit. Minimum size: 73 mm deep.

2.6. OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

- 2.6.1. Electro-galvanized, sectional, screw ganging steel boxes, minimum size 75 mm x 50 mm x 63.5 mm with two double clamps to take non-metallic sheathed cables.

2.7. FITTINGS - GENERAL

- 2.7.1. Bushing and connectors with nylon insulated throats.
- 2.7.2. Knock-out fillers to prevent entry of debris.
- 2.7.3. Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- 2.7.4. Double locknuts and insulated bushings on sheet metal boxes.

2.8. SERVICE FITTINGS

- 2.8.1. 'High tension' receptacle fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish for duplex receptacles. Bottom plate with two knockouts for centered or offset installation.
- 2.8.2. Pedestal type 'low tension' fitting made of 2 piece die cast aluminum with brushed aluminum housing finish to accommodate Amphenol jack connectors.

3. Execution

3.1. INSTALLATION

- 3.1.1. Support boxes independently of connecting conduits.
- 3.1.2. Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- 3.1.3. For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- 3.1.4. Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- 3.1.5. Non-combustible electrical outlet boxes that penetrate a fire separation or a membrane forming part of an assembly required to have a fire-resistance rating, do not require fire stops provided,
  - .1 they do not exceed:
    - .1 100 cm<sup>2</sup> each in area, AND
    - .2 an aggregate area of 650 cm<sup>2</sup> in any 9.3 m<sup>2</sup> of surface area, AND
  - .2 the annular space between the membrane and the box does not exceed 3 mm.
- 3.1.6. Where the conditions of clause 3.1.5 are not met, provide fire stops for the outlet boxes.

- 3.1.7. Opposing outlets on non-fire rated partition walls shall have a minimum 150 mm horizontal separation. Outlets shall not be mounted back to back.
- 3.1.8. Conform to the fire stopping requirements of the building code: unless provided with a fire stop in accordance with CAN/ULC-S115, "Fire Tests of Fire Stop Systems", electrical outlet boxes on opposite sides of a vertical fire separation required to have a fire-resistance rating shall be separated by a horizontal distance of not less than 600 mm, or be installed in adjacent stud cavities.

END OF SECTION

1. General

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 31.00 – SPLITTERS, JUNCTION, PULL BOXES AND CABINETS
- 1.1.3. Section 26 05 32.00 – OUTLET BOXES, CONDUIT BOXES AND FITTINGS

1.2. REFERENCES

- 1.2.1. CAN/CSA C22.2 No.18- Outlet Boxes, Conduit Boxes, and Fittings, latest edition.
- 1.2.2. CSA C22.2 No.45- Rigid Metal Conduit, latest edition.
- 1.2.3. CSA C22.2 No.56- Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit, latest edition.
- 1.2.4. CSA C22.2 No.83- Electrical Metallic Tubing, latest edition.
- 1.2.5. CSA C22.2 No.211.2- Rigid PVC (Unplasticized) Conduit, latest edition.
- 1.2.6. CAN/CSA C22.2 No.227.3- Flexible Non-metallic Tubing, latest edition.
- 1.2.7. CSA C22.2 No.227.1 - Electrical Non-Metallic Tubing, latest edition.

2. Products

2.1. CONDUITS

- 2.1.1. Rigid metal conduit: to CSA C22.2 No.45, galvanized steel or aluminum threaded.
- 2.1.2. Epoxy coated conduit: to CSA C22.2 No.45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- 2.1.3. Electrical metallic tubing (EMT): to CSA C22.2 No.83, with couplings.
- 2.1.4. Rigid PVC conduit: to CSA C22.2 No.211.2.
- 2.1.5. Flexible metal conduit: to CSA C22.2 No.56, steel or liquid-tight flexible metal.
- 2.1.6. Electrical non-metallic tubing (ENT): to CSA C22.2 No. 227, with couplings.

2.2. CONDUIT FASTENINGS

- 2.2.1. One hole steel straps to secure surface conduits NPS 2 and smaller. Two hole steel straps for conduits larger than NPS 2.
- 2.2.2. Beam clamps to secure conduits to exposed steel work.
- 2.2.3. Channel type supports for two or more conduits at 1 m oc.
- 2.2.4. Hot dipped galvanized threaded rods, 6 mm dia. minimum, to support suspended channels.

2.3. CONDUIT FITTINGS

- 2.3.1. Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- 2.3.2. Factory "ells" where 90 bends are required for 1" and larger conduits when a hydraulic bender is not used.

- 2.3.3. Connectors, and couplings for EMT conduit are to be set-screw steel type. Below the level of suspended ceilings, in a sprinklered environment, provide watertight fittings and "O" rings on all conduit runs and when conduit is terminated at any piece of electrical equipment.
- 2.3.4. Provide plastic bushings for all connectors, rigid nipples and rigid conduit 32mm or larger.
- 2.4. EXPANSION FITTINGS FOR RIGID CONDUIT
  - 2.4.1. Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- 2.5. FISH CORD
  - 2.5.1. Fish cord to be made of polypropylene.
- 3. Execution
  - 3.1. INSTALLATION
    - 3.1.1. All conduits on project to be surface mounted. No conduits in cast in-place concrete or in slab conduits will be allowed unless written consent is received from the Engineer's Representative and Owner. Only once approved by the Engineer's Representative and Owner do the clauses contained within this section and the respective sections relating to conduits in cast in-place concrete or in slab conduits apply.
    - 3.1.2. Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
    - 3.1.3. Conceal conduits except in mechanical and electrical service rooms or in unfinished areas. Conduits to have their own support system and are to be supported independently of the ceiling grid or ceiling support system.
    - 3.1.4. Where vertically run conduit passes through a slab, Contractor to provide a 100mm high concrete pad with the pad extending 100mm on all sides of the conduit.
    - 3.1.5. Use electrical metallic tubing (EMT) conduit except where specified otherwise.
    - 3.1.6. Use epoxy coated conduit in corrosive areas.
    - 3.1.7. Use rigid galvanized steel threaded conduit where conduit is subject to mechanical injury.
    - 3.1.8. Use rigid PVC conduit underground or in corrosive areas and where indicated.
    - 3.1.9. Use flexible metal conduit for connection to motors or vibrating equipment in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.
    - 3.1.10. Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations. Use only liquid tight fittings when using liquid tight flexible metal conduit. Liquid tight flexible metal conduit to have a jacket with an FT6 rating when used in plenums otherwise provide a minimum FT4 rating.
    - 3.1.11. Use explosion proof flexible connection for connection to explosion proof motors.
    - 3.1.12. Install conduit sealing fittings in hazardous areas. Fill with compound.
    - 3.1.13. Minimum conduit size for lighting and power circuits: NPS 21mm, unless otherwise noted on the drawings.
    - 3.1.14. Install EMT conduit from a raised floor branch circuit panel to outlet boxes located in sub floor.
    - 3.1.15. Install EMT conduit from a raised floor branch circuit panel to junction box in sub-floor. Run flexible metal conduit from junction box to outlet boxes for equipment connections in sub-floor.

- 3.1.16. Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- 3.1.17. Mechanically bend steel conduit over 19 mm dia.
- 3.1.18. Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- 3.1.19. Install fish cord in empty conduits.
- 3.1.20. Run two 27mm spare conduits up to ceiling space and two 27mm spare conduits down to sub-floor space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes or in case of an exposed concrete slab, terminate each conduit in flush concrete or surface type box.
- 3.1.21. Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- 3.1.22. Dry conduits out before installing wire.
- 3.1.23. All cutting and patching of masonry/concrete floors, walls, and roof for electrical services shall be by this Division. Obtain approval from the Landlord and/or structural Engineer's Representative before cutting any structural walls or floors. Cutting and drilling shall only be at times allowed by the Landlord. Check and verify the location of existing mechanical and electrical services in walls and below the floor slab in all areas requiring core drilling and cutting. Protect all tenant areas where core drilling occurs. Carefully chip top and bottom of slab to expose rebar to minimize cutting of rebar when core drilling. Provide x-ray study before drilling or cutting where required by the Landlord and/or structural Engineer's Representative.
- 3.1.24. Provide sleeves for all new conduit passing through floor and roof slabs, beams, concrete walls and slab to slab partitions, etc.
- 3.1.25. Where cables and conduits pass through partitions and through floors that are not fire rated, provide an air-tight seal around the cables and conduits.
- 3.1.26. Where cables and conduits pass through floors and fire rated walls, pack space between conduit (or cable) and sleeve with an approved fire stop as specified in Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 3.1.27. Prior to installation of any wire or cable in the ducts, pull through each duct a flexible mandrel not less than 300 mm long and size for the internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely. Notify the engineer's representative no less than 48 hours prior to the event, so that the engineer's representative may witness.
- 3.2. SURFACE CONDUITS
  - 3.2.1. Run parallel or perpendicular to building lines.
  - 3.2.2. Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
  - 3.2.3. Run conduits in flanged portion of structural steel.
  - 3.2.4. Group conduits wherever possible on suspended or surface mounted channels.
  - 3.2.5. Do not pass conduits through structural members, except as indicated.
  - 3.2.6. Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
  - 3.2.7. Conduits must not be used to support other conduits.
- 3.3. CONCEALED CONDUITS
  - 3.3.1. Run parallel or perpendicular to building lines.
  - 3.3.2. Do not install horizontal runs in masonry walls.



- 3.3.3. Do not install conduits in terrazzo or concrete toppings.
- 3.4. CONDUITS IN CAST-IN-PLACE CONCRETE
  - 3.4.1. Locate to suit reinforcing steel. Install in centre one third of slab.
  - 3.4.2. Protect conduits from damage where they stub out of concrete.
  - 3.4.3. Install sleeves where conduits pass through slab or wall.
  - 3.4.4. Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.
  - 3.4.5. Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.
  - 3.4.6. Encase conduits completely in concrete with minimum 25 mm concrete cover.
  - 3.4.7. Organize conduits in slab to minimize cross-overs.
- 3.5. CONDUITS IN CAST-IN-PLACE SLABS ON GRADE
  - 3.5.1. Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.
- 3.6. CONDUITS UNDERGROUND
  - 3.6.1. Slope conduits to provide drainage.
  - 3.6.2. For all non-PVC conduits run underground, provide waterproof joints with heavy coat of bituminous paint.

END OF SECTION

1. General

1.1. WORK INCLUDED

- 1.1.1. Section 26 00 05.00 – REGIONAL SUPPLEMENTAL REQUIREMENTS.
- 1.1.2. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.3. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

1.2. REFERENCES

- 1.2.1. CSA C22.1 - Canadian Electrical Code, Part 1, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

- 1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

2. Products

2.1. EQUIPMENT IDENTIFICATION

- 2.1.1. Identify electrical equipment with nameplates as follows:

- .1 Lamacoid 3 mm thick plastic engraved sheet, black or red face, white core, mechanically attached with self-tapping screws or rivets.
- .2 White letters 12 mm high for major switchboards, panelboards and power transformers.
- .3 White letters 12 mm high for terminal boxes, junction boxes, grid boxes, splitter boxes, disconnect switches starters and contactors.
- .4 Allow for an average of fifty (50) to one hundred (100) letters per nameplate.
- .5 Identification to be in English.
- .6 Black nameplates for normal power.
- .7 Red nameplates for emergency power.
- .8 Blue nameplates for UPS Power.

Sample:

SWITCHBOARD AA  
3000A, 600/347V, 3 PH, 4W, 50kA  
FED FROM SWITCHBOARD AAA  
MANUFACTURED IN MM/YYYY; SERIAL NUMBER ##-####

- .9 Wording on nameplates to be approved by Engineer's Representative prior to manufacture.

- .10 Nameplates for splitters, terminal cabinets, grid boxes, pull boxes, and junction boxes are to indicate the system and/or voltage characteristics.
- .11 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .12 Transformers: indicate capacity, primary and secondary voltages, and upstream source where Transformer is fed from.
- .13 Mechanical equipment: indicate equipment name and full circuit number including panel board identification.
- .14 Switchboards, Distribution Panels, and Panelboards: Name designation, rated ampacity, voltage, number of phases, and number of wires, if neutral is rated for 200%, interrupting capacity in units of kA, upstream source from which panelboard is fed, month and year manufactured, and serial number.
- .15 Automatic Transfer Switches (ATS): Name designation, rated ampacity, voltage, transfer switch arrangement (e.g. 3 pole with no neutral, 3 pole with solid neutral, 3 pole with overlapping neutral, 4 pole), withstand rating in units of kA, upstream normal power source from which ATS is fed, upstream emergency power source from which ATS is fed, month and year manufactured, and serial number.
- .16 Generators:
  - .1 Indicate kW rating, kVA rating, voltage, number of phases, number of wires, generator neutral grounding arrangement, year and month manufactured, and engine and alternator serial number.
  - .2 Indicate Maximum Site Design Load (as defined in CSA C282) in units of kW; engineering firm responsible for Maximum Site Design Load calculation; drawing number, issuance title (e.g. Issued for Construction, Electrical Contactor As-Built, Issued for CCN-E01, etc.), and issuance date which Maximum Site Design Load is based on. It is very important for future renovations and load additions that it is clear when the Maximum Site Design Load is from and what drawing it is based on.
  - .3 Sample nameplate:

**Generator G1**  
**600 kW / 750 kVA**  
**600/347V, 3 PH, 4W, Wye solidly grounded**  
**Connected to ATS-PHXA**  
**MANUFACTURED IN MM/YYYY; SERIAL NUMBER ##-####**  
**Maximum Site Design Load 420 kW**

- .17 Provide nameplates on all electrical equipment including:
  - .1 Splitters, terminal cabinets, grid boxes, pull boxes, and junction boxes
  - .2 Disconnects, starters and contactors, and Mechanical equipment
  - .3 Transformers
  - .4 Switchgear, Switchboards, Distribution Panels, and Panelboards

- .5 Automatic Transfer Switches
- .6 Generators
- .7 UPS equipment
- .8 Lighting control systems

2.1.2. Labels:

- .1 A printed label, similar to a Brady label 6 mm high letters unless specified otherwise, for internal components, such as relays, fuses, terminal blocks.

2.2. WIRING IDENTIFICATION

- 2.2.1. Identify wiring with permanent legible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- 2.2.2. Maintain phase sequence and colour coding throughout.
- 2.2.3. Colour code: in conformance with the Electrical Code.
- 2.2.4. Use colour coded wires in communication cables and control wiring, matched throughout system.

2.3. CONDUIT AND CABLE IDENTIFICATION

- 2.3.1. Colour code conduits, boxes and metallic sheathed cables.
- 2.3.2. Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- 2.3.3. Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	<b>Colour</b>
up to 250 V Normal Power	Green
up to 600 V Normal Power	Blue
up to 250 V Emergency Power	Black
up to 600 V Emergency Power	Orange
High Voltage, greater than 750 V	Large independent label clearly identifying the voltage
Telephone/Data	White
Fire alarm	Red
Other security systems	Yellow
Controls	Purple

2.4. RECEPTACLE IDENTIFICATION

- 2.4.1. All receptacles including systems furniture receptacles and whip connections are to be labelled with the respective circuit numbers with a printed label, similar to a Brady label, with 12mm characters. Circuit number to include full circuit number including panel board identification.
- 2.4.2. Label to be placed on wall above cover plate or on cover plate. Location of label to be consistent throughout project.

2.5. MANUFACTURERS AND CSA LABELS

- 2.5.1. Visible and legible after equipment is installed.

2.6. WARNING SIGNS

- 2.6.1. Provide warning signs, as specified, and/or to meet the requirements of the Inspection Authorities.
  - 2.7. FUSE SIZE LABELLING
    - 2.7.1. Contractor to install a label on all equipment with fuses to identify the fuse sizes and class that are installed in the respective equipment.
    - 2.7.2. Contractor to also install a label on all equipment with fuses to identify the maximum allowable fuse size based on the size of the respective feeders.
  - 3. Execution
    - 3.1. NOT USED
- END OF SECTION

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
    - 1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
  - 1.2. SHOP DRAWINGS AND PRODUCT DATA
    - 1.2.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
    - 1.2.2. Submit drawings showing size, type and location of all access doors, for review, before installation.
2. Products
  - 2.1. MATERIALS
    - 2.1.1. Access doors shall be Acudor, or LeHage or Mifab. Coordinate with other trades on site. All access doors on site shall be from the same manufacturer.
    - 2.1.2. Doors in solid walls shall be equal to Acudor Model UF5000 with 14 U.S. gauge, prime painted steel door panel, rust resistant concealed hinges and screwdriver operated lock.
    - 2.1.3. Doors in plaster partitions or ceiling shall be equal to Acudor model AP5010 16 US gauge, prime painted steel, concealed hinges and screwdriver operated lock.
    - 2.1.4. Doors in drywall partitions or ceiling shall be equal to Acudor model DW 5040, 20 US gauge, prime painted steel, concealed hinges and screwdriver operated lock.
    - 2.1.5. Access doors in fire rated walls or ceilings shall be equal to Acudor Model FW 5050 and ULC labeled with insulated door panel, concealed hinge, self-closing, self-latching, and prime painted. Provide master key operated catch in areas accessible to the public.
    - 2.1.6. All doors in tiled walls shall be 16 US gauge, stainless steel, type 304 with #4 satin finish, concealed hinges, wall frame and screw driver operated lock.
    - 2.1.7. Minimum size of doors shall be 300 mm x 450 mm. Wherever possible 600 mm x 600 mm doors shall be used.
3. Execution
  - 3.1. INSTALLATION
    - 3.1.1. All parts of the installation requiring periodic maintenance shall be accessible. Wherever pull boxes, junction boxes and other appurtenances are concealed by building construction, access doors shall be furnished by this section and installed under the respective Trade Sections (i.e. masonry, plaster, drywall, tile, etc.). This section is responsible for the proper location of the access doors.
    - 3.1.2. Wherever possible, items requiring access shall be located in easily accessible areas (i.e. exposed or T-bar ceilings).
    - 3.1.3. Group items in order to minimize the number of access doors required.

- 3.1.4. Each access door shall be installed to provide complete access to equipment for maintenance and servicing.
- 3.1.5. Make any changes to locations of access doors as directed by the Engineer's Representative.
- 3.1.6. The final installed locations of all access doors shall be shown on the As-Built Record Drawings.

END OF SECTION

1. General

1.1. WORK INCLUDED

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

2. Products

2.1. MATERIALS

2.1.1. Sleeves passing through stud partitions shall be 0.75 mm 22 US Gauge steel.

2.1.2. Sleeves passing through masonry walls shall be Schedule 40 steel pipe.

2.1.3. Sleeves passing through floors in finished areas and concealed spaces may be sheet metal or factory fabricated reusable type.

2.1.4. Where a housekeeping pad cannot be installed, sleeves passing through floors with waterproof membrane shall have a flashing collar, 50 mm wide at the membrane level. Flashing collar shall be continuously welded to sleeve. Sleeves shall extend 50 mm above the finished floor and shall be Schedule 40 steel pipe.

2.1.5. Where conduits pass through exterior foundation walls 6 mm thick steel sleeve of inside diameter not less than 75 mm greater than the outside diameter of the pipe shall be used and shall be complete with anchor collar. Thunderline Link-Seal wall seal or approved equal shall be used for the annular space between the sleeve and the conduit. A reinforced concrete bridge shall be installed between the wall and the adjacent undisturbed soil.

2.1.6. Provide adequate bracing for support of sleeves during concrete and masonry work.

3. Execution

3.1. INSTALLATION

3.1.1. Arrange for all chases and formed openings in walls and floors as required by the Electrical Division for the Electrical services. These chases and openings shall not be larger than necessary to accommodate the equipment and services. Advise on these requirements well in advance, before the concrete is poured and the walls are built. All necessary sleeves and inserts shall be supplied by this Division.

3.1.2. Chases and openings not located in accordance with the above provisions shall be made at the expense of this Division. Cutting of structural members shall not be permitted without specified written acceptance of the Engineer's Representative.

3.1.3. Provide sleeves for all service penetrations through walls, partitions, floor slabs, plenums and similar barriers. At non-rated barriers fill the annular space between the service and the sleeve with fire rated insulation as specified for rated separations and caulk around the edges with a minimum 12 mm thick of fire rated compound or acoustic non-setting mastic.

3.1.4. Through all fire or smoke separations, after testing, the annular space between conduit sleeves shall be fire stopped.

3.1.5. Where holes are to be installed in existing structure, contractor is to core drill the holes required. Contractor is required to scan all areas prior to coring and confirm layout with structural engineer prior to completing work. When installing sleeves in existing structures,



sleeves shall be provided as specified complete with a combination puddle/anchor flange bolted to the floor. Seal watertight between the flange and the floor.

- 3.1.6. All sleeves are to extend 150mm above finished floor to accommodate a 100mm concrete pad. Contractor to pour the concrete pad with the pad extending 100mm on all sides of the sleeve.

END OF SECTION

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
2. Products
  - 2.1. MATERIALS
    - 2.1.1. All services and materials used for the cutting and patching shall meet all requirements specified in Div. 00, and Section 26 05 01.00, and shall be carried out by experienced workers.
    - 2.1.2. Include for all cutting and patching for all Electrical services.
3. Execution
  - 3.1. INSTALLATION
    - 3.1.1. Cut all openings no larger than is required for the services. Core drill for individual services.
    - 3.1.2. Obtain approval from the structural Engineer's Representative before cutting or core drilling any openings or holes in slabs or structural elements.
    - 3.1.3. Locate all openings in structure elements requiring cutting and patching, and x-ray the structure to obtain Structural Engineer's Representative's approval prior to cutting or core drilling of existing structure. Make adjustments to location of openings as required to minimize cutting of rebar, and completely avoiding electrical conduit.
      - .1 Cut holes through slabs only.
      - .2 Do not cut holes through beams.
      - .3 Holes to be cut are 200 mm (Diameter) or smaller only.
      - .4 Maintain at least 100 mm clear from all beam faces. Space at least 3 hole diameters on Centre.
      - .5 For holes that are required closer than 25% of slab span from the supporting beam face, use cover meter above the slab to clear slab top bars.
      - .6 For holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars.
    - 3.1.4. X-ray scanning:
      - .1 X-rays shall be performed by a qualified technician, in a safe manner and in accordance with all applicable regulations governing this activity. The company shall be licensed by the Canadian Nuclear Safety Commission (CNSC), and all radiography work shall be performed in accordance with the Nuclear Safety and Control Act.
      - .2 Follow any safety requirements stipulated by the property manager.
      - .3 Minimum requirements: All people must be evacuated within a radius of 10 m from each exposure location. Prior to conducting exposures verify this "safe zone". If the 10 m radius includes public areas such as a sidewalk, lobby, or elevator, these areas must be controlled (e.g. elevators shut down or prevented from stopping on floors at which exposures are taking place). In addition, if exposure locations are near the walls of

adjacent tenants, ensure the notification and evacuation of people within the 10 m radius. The 10 m radius applies to the camera floor and the floor directly below only. The qualified technician shall ensure adequate precautions for the additional floors above and below the camera floor.

- 3.1.5. Patch all openings after services have been installed to match the surrounding finishes.
- 3.1.6. In existing areas all cutting, and core drilling for individual services except where specifically noted, is part of this division work.
- 3.1.7. The cost of x-ray scanning, cutting, patching and finishing is included in this division contract.

END OF SECTION

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
    - 1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
    - 1.1.3. Section 26 05 05.00 – MOUNTING HEIGHTS.
    - 1.1.4. Section 26 05 53.00 – IDENTIFICATION.
  - 1.2. REFERENCES
    - 1.2.1. CSA C22.2 No. 29 – Panelboards and Enclosed Panelboards, latest edition.
    - 1.2.2. CSA C22.2 No. 5 – Molded-case circuit breakers, molded-case switches and circuit-breaker enclosures, latest edition.
  - 1.3. SHOP DRAWINGS AND PRODUCT DATA
    - 1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
    - 1.3.2. Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.
2. Products
  - 2.1. PANELBOARDS
    - 2.1.1. Panelboards: product of one manufacturer.
    - 2.1.2. Install circuit breakers in panelboards before shipment.
    - 2.1.3. In addition to CSA requirements manufacturer's nameplate must show fault current that the panel including all breakers have been built to withstand.
    - 2.1.4. Panelboards to have the following minimum ratings for interrupting capacity or as indicated on the drawings or panel schedules.
      - .1 120/208V panelboards – 10kA
      - .2 347/600V panelboards – 22kA
    - 2.1.5. Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
    - 2.1.6. Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated. Provide an additional 20% of space within each panelboard in addition to what is shown on the drawings when a separate panel schedule is not provided for a specific panelboard.
    - 2.1.7. Two keys for each panelboard and key panelboards alike.
    - 2.1.8. Panelboards to be copper bus unless identified otherwise.
    - 2.1.9. Where identified on the drawings or schedules, provide a copper neutral bus sized to 200% of the mains rating for panels.
    - 2.1.10. Mains: suitable for bolt-on breakers.

- 2.1.11. Trim with concealed front bolts and hinges.
- 2.1.12. Trim and door finish: baked grey enamel.
- 2.1.13. Enclosure to be CSA Type 2 sprinkler proof.
- 2.1.14. Surge Protection Device as required.
- 2.1.15. Series ratings may be acceptable. Panels to be labeled as such. Manufacturing to supply supporting data.
  
- 2.2. MOULDED CASE CIRCUIT BREAKERS
  - 2.2.1. Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg. C. ambient.
  - 2.2.2. Common-trip breakers: with single handle for multi-pole applications.
  - 2.2.3. Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
  - 2.2.4. Main breaker, where indicated: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
  - 2.2.5. Lock-on devices for 10 % of 15 to 30 A breakers installed. Turn over unused lock-on devices to Owner.
  - 2.2.6. Where breakers are identified to feed high intensity discharge (HID) lighting, provide breakers that are rated and designed for use with HID lighting.
  - 2.2.7. Provide one breaker per designated breaker space. Multiple breakers contained in one housing or twin breakers are not acceptable.
  
- 2.3. EQUIPMENT IDENTIFICATION
  - 2.3.1. Provide equipment identification in accordance with Section 26 05 53.00 – IDENTIFICATION.
  - 2.3.2. Complete circuit directory with typewritten legend showing location and load of each circuit.
  
- 2.4. MANUFACTURERS
  - 2.4.1. The following are acceptable manufacturers:
    - .1 Schneider Electric
    - .2 Eaton Cutler-Hammer
    - .3 Siemens
  
- 3. Execution
  - 3.1. INSTALLATION
    - 3.1.1. Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
    - 3.1.2. Install surface mounted panelboards on galvanized unistrut stand-offs or on fire rated plywood backboards. The plywood backboards are to be as per Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
    - 3.1.3. Mount panelboards at height specified in Section 26 05 05.00 – MOUNTING HEIGHTS.
    - 3.1.4. Connect loads to circuits.

3.1.5. Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

1. General

1.1. WORK INCLUDED

- 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
- 1.1.3. Section 26 05 05.00 – MOUNTING HEIGHTS.
- 1.1.4. Section 26 05 53.00 – IDENTIFICATION.
- 1.1.5. Section 26 51 13.00 – LIGHTING EQUIPMENT.

1.2. SHOP DRAWINGS AND PRODUCT DATA

- 1.2.1. Submit shop drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.

2. Products

2.1. SWITCHES

- 2.1.1. 20 A, single pole, double pole, three-way, or four-way specification grade switches. Voltage rating of the switch to be as per the contract documents.
- 2.1.2. Manually-operated general purpose switches with following features:
  - .1 Terminal holes approved for No. 10 AWG wire.
  - .2 Silver alloy contacts.
  - .3 Urea or melamine moulding for parts subject to carbon tracking.
  - .4 Suitable for back and side wiring.
  - .5 Decora Style specification grade Rocker switch.
  - .6 Colour to be selected by Architect/Engineer's Representative.
- 2.1.3. Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

2.2. RECEPTACLES

- 2.2.1. All receptacles to be specification grade.
- 2.2.2. Duplex specification receptacles, Decora style CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
  - .1 Thermoplastic with impact-resistant nylon face moulded housing.
  - .2 Suitable for No. 10 AWG for back and side wiring.
  - .3 Eight back wired entrances, four side wiring screws.
  - .4 Triple wipe contacts and riveted grounding contacts.
- 2.2.3. Hospital grade receptacles:
  - .1 Hospital grade with green dot symbol, tamper-resistant, extra heavy duty, modular plug-in type, 15 ampere, 125 V, 2-pole, 3-wire U-ground duplex receptacles complete with front circuit identification area.
  - .2 Suitable for No. 10 AWG for back and side wiring.

- .3 Eight back wired entrances, four side wiring screws.
- .4 Triple wipe contacts and riveted grounding contact.
- 2.2.4. Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
  - .1 Thermoplastic moulded housing.
  - .2 Suitable for No. 10 AWG for back and side wiring.
  - .3 Four back wired entrances, 2 side wiring screws.
- 2.2.5. Other receptacles with ampacity and voltage as indicated.
- 2.2.6. Receptacles to be coloured as follows:
  - .1 Normal Power – Colour to be selected by Architect/Engineer's Representative.
  - .2 Emergency/Essential Power – Red.
  - .3 Isolated Ground – Orange.
  - .4 Switched – Gray.
  - .5 UPS – Blue.
- 2.2.7. All dwelling receptacles of CSA configuration 5-15R and 5-20R shall be tamper resistant receptacles and shall be so marked; receptacles dedicated for microwaves, refrigerators, freezers or those receptacles located in an attic or crawl space shall not be required to be tamper-resistant.
- 2.2.8. Electrical Contractor shall coordinate with furniture supplier to identify switched circuits prior to installation.
- 2.3. MANUFACTURERS
- 2.3.1. The switches and wiring devices shall be of one manufacturer throughout the project.
- 2.3.2. The following are acceptable manufacturers:
  - .1 Legrand.
  - .2 Hubbell.
  - .3 Cooper.
  - .4 Leviton.
- 2.4. DIMMERS
- 2.4.1. Dimmers shall be 600W, 1500W, 2000W.
  - .1 Full range, continuously variable control of light intensity.
  - .2 Vertical slider allowing the light level to be set by the user.
  - .3 Slide to Off.
  - .4 Capable of operating at rated capacity.
  - .5 Power failure memory.
  - .6 Dimmers shall be available for direct control of incandescent, magnetic low voltage, electronic low voltage, fluorescent, and LED.
- 2.4.2. Incandescent dimmers.
  - .1 Direct control of up to a full 20A lighting circuit.
- 2.4.3. Electronic (solid-state) Low Voltage (ELV) transformer dimmers (incandescent).
  - .1 Circuitry designed to control the input of Electronic (solid state) Low Voltage transformers.



- .2 Control up to 600W of Electronic Low Voltage load.
- .3 Reset-able overload protection when capacity is exceeded.
- 2.4.4. Magnetic Low-Voltage (MLV) transformer dimmers.
  - .1 Designed to control and provide a symmetrical AC wave form to input of magnetic low voltage transformers per UL 1972 section 5.11.
  - .2 Direct control of up to 1500VA of Magnetic Low Voltage load.
  - .3 Dimmer shall be suitable to control dimming ballast as specified in Section 26 51 13.00 – LIGHTING EQUIPMENT.
- 2.4.5. LED dimmers.
  - .1 Slide to Off only. Must match driver and LED requirements.
- 2.4.6. Manufacturers
  - .1 Lutron Maestro Series.
  - .2 Leviton True Touch Series.
- 2.5. SPECIAL WIRING DEVICES
- 2.5.1. Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic lens flush type.
- 2.6. COVER PLATES
- 2.6.1. Cover plates for wiring devices.
- 2.6.2. Cover plates from one manufacturer throughout project.
- 2.6.3. Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- 2.6.4. Provide stainless steel cover plates, suitable for the respective device, for all devices mounted in flush-mounted outlet boxes located in finished areas.
- 2.6.5. Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- 2.6.6. Weatherproof rain tight while-in-use metal cover, complete with gaskets for duplex receptacles located outside or as indicated.
- 2.6.7. Weatherproof rain tight while-in-use metal cover, complete with gaskets for single receptacles or switches located outside or as indicated.
- 3. Execution
- 3.1. INSTALLATION
- 3.1.1. Switches:
  - .1 Install single throw switches with handle in "UP" position when switch closed.
  - .2 Install switches in gang type outlet box when more than one switch is required in one location.
  - .3 Mount toggle switches at height specified in Section 26 05 05.00 – MOUNTING HEIGHTS or as indicated.
- 3.1.2. Receptacles:
  - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

- .2 Mount receptacles at height specified in Section 26 05 05.00 – MOUNTING HEIGHTS or as indicated.
  - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
  - .4 Install hospital grade receptacles in all patient care areas in healthcare applications.
- 3.1.3. Dimmers:
- .1 Install dimmers as indicated. Provide suitable clearances in multi-gang boxes as recommended by the manufacturer to maintain the dimmer rating.
  - .2 Coordinate the dimmer selection with the ballast/driver to be controlled, to ensure compatibility.
- 3.1.4. Cover plates:
- .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
  - .2 Install suitable common cover plates where wiring devices are grouped.
  - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
- 3.1.5. Labelling
- .1 Provide labels with panel name and circuit number on all receptacles in conformance with Section 26 05 53.00 – IDENTIFICATION.

END OF SECTION

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
    - 1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
  - 1.2. REFERENCES
    - 1.2.1. CSA C22.2 No. 5 – Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, latest edition.
  - 1.3. SHOP DRAWINGS AND PRODUCT DATA
    - 1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS
    - 1.3.2. Include time-current characteristic curves for breakers with ampacity of 400 A and over or with interrupting capacity of 22,000 A symmetrical (RMS) and over at system voltage.
2. Products
  - 2.1. BREAKERS GENERAL
    - 2.1.1. Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg. C. ambient.
    - 2.1.2. Common-trip breakers: with single handle for multi-pole applications.
    - 2.1.3. Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
    - 2.1.4. Circuit breakers with interchangeable trips as indicated.
  - 2.2. THERMAL MAGNETIC BREAKERS
    - 2.2.1. Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
  - 2.3. MAGNETIC BREAKERS
    - 2.3.1. Moulded case circuit breakers to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.
  - 2.4. FUSED THERMAL MAGNETIC BREAKERS
    - 2.4.1. Fused thermal magnetic breakers with current limiting fuses internally mounted. Time current limiting characteristics of fuses coordinated with time current tripping characteristics of circuit breaker. Coordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker. Fuses individually removable and interlocked with breaker. The removal of fuse cover, blowing of a fuse or removal of a fuse, shall trip the breaker.
  - 2.5. SOLID STATE TRIP BREAKERS

- 2.5.1. Moulded case circuit breaker to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition and long time, short time, instantaneous tripping for phase and ground fault short circuit protection.

2.6. ACCESSORIES

2.6.1. Include:

- .1 shunt trip, when electrically operated or when indicated.
- .2 auxiliary switches, when electrically operated or when indicated.
- .3 motor-operated mechanism, when electrical operation indicated.
- .4 on-off locking device.
- .5 handle mechanism.

2.7. MANUFACTURERS

2.7.1. The following are acceptable manufacturers:

- .1 Schneider Electric
- .2 Eaton Cutler-Hammer
- .3 Siemens

3. Execution

3.1. INSTALLATION

3.1.1. Install circuit breakers as indicated.

END OF SECTION

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
    - 1.1.2. Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
    - 1.1.3. Section 26 05 53.00 – IDENTIFICATION.
  - 1.2. REFERENCE
    - 1.2.1. CSA C22.2 No. 4 – Enclosed Switches, latest edition.
    - 1.2.2. CSA C22.2 No. 39 – Fuse-holder Assemblies, latest edition.
  - 1.3. SHOP DRAWINGS AND PRODUCT DATA
    - 1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
2. Products
  - 2.1. DISCONNECT SWITCHES
    - 2.1.1. Fusible or non-fusible, horsepower rated disconnect switch in CSA Type 2 sprinkler proof enclosure, size as indicated.
    - 2.1.2. Provision for padlocking in on-off switch position by three locks.
    - 2.1.3. Mechanically interlocked door to prevent opening when handle in ON position.
    - 2.1.4. Fuses: size as indicated, class J, current limiting, in accordance with Section 26 28 14.00 – FUSES - LOW VOLTAGE.
    - 2.1.5. Fuse-holders: suitable without adaptors, for type and size of fuse indicated.
    - 2.1.6. Quick-make, quick-break action.
    - 2.1.7. ON-OFF switch position indication on switch enclosure cover.
  - 2.2. EQUIPMENT IDENTIFICATION
    - 2.2.1. Provide equipment identification in accordance with Section 26 05 53.00 – IDENTIFICATION.
    - 2.2.2. Indicate name of load controlled on nameplate.
    - 2.2.3. Provide a Lamacoid nameplate that indicates the replacement fuse size as well as the maximum allowable fuse size for that disconnect based upon the sizing of the feeder.
  - 2.3. MANUFACTURERS
    - 2.3.1. The following are acceptable manufacturers:
      - .1 Schneider Electric.
      - .2 Eaton Cutler-Hammer.
      - .3 Siemens.

3. Execution

3.1. INSTALLATION

3.1.1. Install disconnect switches complete with fuses if applicable.

END OF SECTION

1. General
  - 1.1. WORK INCLUDED
    - 1.1.1. Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
    - 1.1.2. Section 26 05 04.00 – SUBMITTALS – SHOP DRAWINGS.
    - 1.1.3. Section 26 05 21.00 – WIRES AND CABLES 1000V.
    - 1.1.4. Section 26 06 05.16 – LUMINAIRE SCHEDULE.
  - 1.2. REFERENCES
    - 1.2.1. CSA C22.2 No. 74 – Equipment for Use with Electric Discharge Lamps, latest edition.
    - 1.2.2. The Consortium of Energy Efficiency (CEE) guidelines, latest edition.
    - 1.2.3. IESNA LM-79 – Approved Method: Electric and Photometric Measurements of Solid-State Lighting Products, latest edition.
    - 1.2.4. IESNA LM-80 – Approved Method: Measuring Lumen Maintenance of LED Light Sources, latest edition.
    - 1.2.5. The Certified Ballast Manufacturers Association (CBM) standards, latest edition.
    - 1.2.6. NEMA 410 – Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts, latest edition.
  - 1.3. SUBSTITUTION
    - 1.3.1. The lighting equipment for this project and specified herein has been carefully selected for its ability to meet the project's luminous environment requirements. Manual and computer calculations have been performed to ensure that the lighting equipment that has been specified complies with established criteria. **The Engineer's Representative reserves the right not to accept any alternates or substitutions.** If alternates or substitutions are entertained, then it is the responsibility of the Contractor/Supplier to provide all information required herein and detailed layouts and lighting calculations demonstrating the performance of the alternate luminaire meets or exceeds the original lighting design while not consuming any additional energy. The Contractor/Supplier is responsible to ensure the light levels provided in the alternate submittal package will achieve the design light levels. Where the light levels are not achieved, the Contractor is responsible to replace the luminaire with a luminaire that will meet the required levels with no increase in energy use at no cost to the Owner. Rather than replacing the luminaires, the Engineer's Representative may accept the installation of additional luminaires by the Contractor at no cost to the Owner in order to achieve the required light levels.
    - 1.3.2. Accompanying the request for a luminaire or lamp substitution, the contractor shall submit a complete lighting calculation report with photometric modeling of the space showing light levels including average, maximum, minimum and max to min values.
  - 1.4. SHOP DRAWING AND PRODUCT DATA
    - 1.4.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS.
    - 1.4.2. Submit a shop drawing for each luminaire specified, including lamp.
    - 1.4.3. Luminaire submittals are to consist of a physical description, manufacturer's specification sheets, dimensioned drawings, and complete photometric data from an independent test


laboratory in the form of IES computer files of the equipment being submitted and hard copy of the photometric report. Coordinate ceiling types to ensure proper supports and luminaire framing.

- 1.4.4. Lamp submittals are to consist of manufacturer's technical data with respective luminaire shop drawing. Submittal to include operating wattage, rated life, colour temperature, base type, lamp shape, CRI, voltage and mercury content.
- 1.4.5. LED submittals are to consist of manufacturer's technical data for diodes and drivers with respective luminaire shop drawing. Submittal to include operating wattage, voltage, maximum distance from drivers, wiring diagrams and lumen output at time of delivery. LED Drivers must have a 50,000 hours warranty.
- 1.4.6. Ballast submittals are to consist of manufacturer's technical data with respective luminaire shop drawing. Submittal to include operating wattage, input voltage, ballast efficiency, maximum distance for remote ballasts, power factor, and operating temperature.
- 1.4.7. Where samples are indicated on the luminaire schedule, they are to be provided with shop drawings at time of shop drawing submittals unless noted otherwise.

#### 1.5. FIXED PER UNIT COST LUMINAIRES

- 1.5.1. Listed in the luminaire schedule are a fixed per unit cost for certain luminaire types. Electrical contractor is responsible for completing a take-off of the drawings to determine quantity of each luminaire type and use the listed fixed unit price to calculate the total cost per luminaire type. The total cost for all luminaires shall be carried in the bid for the electrical contract. Provide a breakdown of the total cost, per luminaire type, that is carried under the electrical contract. All luminaires are to be included in the electrical contract including all luminaires identified with fixed unit costs. The electrical contractor is to include fixed per unit cost luminaires in Light Fixtures – Materials in the standard progress draw breakdown defined in Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
- 1.5.2. The fixed per unit cost excludes applicable taxes and includes lamps and distributor markups. Electrical Contractor is responsible to include in the base bid for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all fixed per unit cost luminaires. Show the applicable taxes as a separate line item.

#### 1.6. CASH ALLOWANCE LUMINAIRES

- 1.6.1. Listed in the luminaire schedule are  'cash allowance' fixtures for certain luminaire types. A complete take-off of the drawings has been done to determine the quantity of each 'cash allowance' luminaire type and the total cost has been carried in the Div-0/1 cash allowance value. The total cost for all 'cash allowance' luminaires are NOT to be carried in the bid for the electrical contract.
- 1.6.2. After tender award to the successful Electrical Contractor, the Consultant shall provide the Electrical Contractor the exact manufacturer/model number(s) of all 'cash allowance' luminaires and the Electrical Contractor shall be responsible for purchasing the fixtures through the monies from the cash allowance.
- 1.6.3. Provide a breakdown of the total cost, per luminaire type, that is carried under the base electrical contract. All luminaires are to be included in the base electrical contract excluding all luminaires identified as 'cash allowance' luminaires. However the Electrical Contractor is to include 'cash allowance' luminaires in Light Fixtures – Materials in the standard progress draw breakdown defined in Section 26 05 01.00 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS once the Consultant provides the Electrical Contractor with the exact manufacturer/model number(s).
- 1.6.4. The cash allowance value carried excludes applicable taxes and includes lamps and distributor markups. Electrical Contractor is responsible to include in the base bid for delivery,



scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all 'cash allowance' luminaires. Show the applicable taxes as a separate line item.

1.7. WARRANTY

1.7.1. The manufacturer shall provide a one-year warranty against defects in material and workmanship for 12 months after initial start-up.

1.7.2. LED's, Drivers, Lamps and ballasts showing signs of premature failure shall be replaced at no cost to the owner

2. Product

2.1. GENERAL

2.1.1. All products must be CSA or CUL approved.

2.2. LAMPS AND LEDS

2.2.1. All Lamps are to meet the standards of the Consortium of Energy Efficiency (CEE) guidelines.

2.2.2. Refer to luminaire schedule for project specific details, and lamps required.

2.2.3. Incandescent, tungsten halogen, high intensity discharge, compact fluorescent and linear fluorescent lamps shall be manufactured by Osram/Sylvania, GE, Philips or Venture unless indicated otherwise on luminaire schedule. Lamps are to be in accordance with the lamp specifications detailed in the Luminaire Schedule and as noted below. Luminaire schedule shall take precedence where differences occur.

2.2.4. All lamps are to be new and are to be from the same manufacturing batch to avoid colour differences. Replace all lamps that exhibit colour shift, or exhibit premature lumen intensity decline, at no cost to the owner.

2.2.5. Incandescent and Halogen

- .1 Incandescent lamp rated life shall be minimum 4,000 hours at rated voltage.
- .2 Halogen lamp rated life shall be minimum 5,000 hours at rated voltage. All MR16 lamps shall be "Constant Colour" or "IR (Infrared) reflective".
- .3 Dichroic reflector lamps are to be provided with glass lens and shall not spill light from the back of the lamp unless noted in the luminaire schedule. Beam pattern and spread are as indicated on luminaire schedule.

2.2.6. Linear Fluorescent

- .1 Linear T5 fluorescent lamps shall have a minimum average rated life of 20,000 hours. The peak lumen output will be at 35 deg. C. The CRI shall be 85 or better and the colour temperature will be 3500 deg. K. unless noted otherwise on the luminaire schedule. Lamp wattage as noted on Luminaire Schedule.
- .2 Linear T8 fluorescent lamps shall have a minimum average rated life of 20,000 hours. The peak lumen output will be at 35 deg. C. The CRI shall be 85 or better and the colour temperature will be 3500 deg. K. unless noted otherwise on the luminaire schedule. Lamp wattage as noted on Luminaire Schedule.
- .3 All linear fluorescents must be low content mercury lamps. The Standard of acceptance are Philips "Alto", Sylvania "Ecologic XP" for T8 lamps, Sylvania "Pentron" for T5 lamps and GE "Ecolux" series.

2.2.7. Compact Fluorescent

- .1 Compact fluorescent lamps are to be single end 4-pin with amalgam technology (lower mercury content) and shall have a minimum average rated life of 16,000 hours. The CRI shall be 82 or better and the colour temperature will be 3500 deg. K. unless noted otherwise on the luminaire schedule. Lamp wattage as noted on Luminaire Schedule.
  - .2 32W compact fluorescents must not be switched repeatedly, and should be on for extended periods of time. Compact fluorescents should not be used with occupancy sensors due to performance issues.
- 2.2.8. High Intensity Discharge (HID)
- .1 Metal halide lamps shall have a minimum 10,000 hour life and a minimum CRI of 60.
  - .2 Ceramic Metal halide lamps shall have a minimum 9,000 hour life and a minimum CRI of 81.
  - .3 All metal halide lamps must be low content mercury lamps.
- 2.2.9. Light Emitting Diodes (LED)
- .1 LEDs shall meet the standards of IESNA LM-79 and LM-80.
  - .2 All LED drivers shall be tested and comply with the maximum in-rush current limits as stated in NEMA 410.
  - .3 LED's shall be manufactured by Luxeon or equal. Colour temperature shall be as indicated on the luminaire schedule. Lamps are to be binned with no visible colour variance (3100K to 3300K maximum range). Rated life for 1 watt white LED shall be 50,000 hours. Lumen output to be maximum based on latest technology at time of delivery.
  - .4 All LED luminaires that present signs of failure on site, within the warranty period, must be replaced at no cost to the owner. If temporary luminaires are required to replace any failed LED luminaires, during the waiting time for parts (i.e. drivers, boards, heat sinks, etc.), the labour cost including installation, temporary luminaire supply, temporary luminaire removal and reinstallation of the LED luminaire must be provided at no cost of the owner. Additional electrical costs, associated with higher Wattage temporary luminaires, must be reimbursed with interest to the owner by the manufacturer.
  - .5 In case of failure of an LED luminaire, complete or part thereof, an independent third party testing Laboratory (approved by Smith + Andersen) shall be commissioned by the manufacturer or vendor to perform tests on samples taken from the failed luminaires installed on corresponding site. All reporting including the test results must be submitted to Smith + Andersen for evaluation and final approval.
  - .6 Any additional time involved by Smith + Andersen will be billed at our hourly rates to the manufacturer or vendor.
- 2.2.10. Induction lamps
- .1 Induction lamps shall have a minimum 100,000 hour life. The Standard of acceptance are Osram/Sylvania and Philips. Minimum CRI of 80.
- 2.3. DRIVERS
- 2.3.1. All drivers are to be tested and comply with maximum in-rush current limits within NEMA 410 standards. This is to be clearly indicated on shop drawing submittal.
- 2.3.2. LED dimming shall be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.

- 2.3.3. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
- 2.3.4. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.
- 2.3.5. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
- 2.3.6. Total Harmonic Distortion less than 20% percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD.
- 2.3.7. Driver must support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
  - .1 Adjustment of forward LED voltage, supporting 3V through 55V.
  - .2 Adjustment of LED current from 200mA to 1.05A at the 100 percent control input point in increments of 1mA
  - .3 Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.
- 2.3.8. Driver must be able to operate for a (+/- 10%) supply voltage of 120V through 277VAC at 60Hz.
- 2.3.9. Driver should be UL Recognized under the component program and shall be modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.
- 2.3.10. Driver shall include ability to provide no light output when the analog control signal drops below 0.5 V, or the DALI/DMX digital signal calls for light to be extinguished and shall consume 0.5 watts or less in this standby. Control deadband between 0.5V and 0.65V shall be included to allow for voltage variation of incoming signal without causing noticeable variation in fixture to fixture output.
- 2.3.11. Over the entire range of available drive currents, driver shall provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0% relative light output, or 100 – 1% light output and step to 0% where indicated. Driver shall respond similarly when raising from 0% to 100%
  - .1 Driver must be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.
- 2.3.12. Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels
- 2.3.13. Drivers to track evenly across multiple fixtures at all light levels, and shall have an input signal to output light level that allows smooth adjustment over the entire dimming range.
- 2.3.14. Driver and luminaire electronics shall deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100-0.1 percent luminaire shall have:
  - .1 LED dimming driver shall provide continuous step-free, flicker free dimming similar to incandescent source.
  - .2 Base specification: Flicker index shall less than 5% at all frequencies below 1000 Hz.
  - .3 Preferred specification: Flicker index shall be equal to incandescent, less than 1% at all frequencies below 1000 Hz.
- 2.3.15. Control Input
  - .1 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers
    - .1 Must meet IEC 60929 Annex E for General White Lighting LED drivers

- .2 Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.
- 2.3.16. Must meet ESTA E1.3 for RGBW LED drivers
- 2.4. BALLASTS
  - 2.4.1. All Ballasts shall comply with CSA C22.2 No. 74 and are to meet or exceed the standards of the Certified Ballast Manufacturers Association (CBM).
  - 2.4.2. All ballasts shall be tested and comply with maximum in-rush current limits as stated in NEMA 410.
  - 2.4.3. Not all ballasts could be used, refer to luminaire schedule for project specific details.
  - 2.4.4. All ballasts shall be manufactured by Osram/Sylvania, Philips, Advance, GE, Lutron or Magnetek unless indicated otherwise. Ballasts shall operate at voltage and control lamps as noted in the Luminaire Schedule.
  - 2.4.5. Ballasts for T5 and T8 lamps will be programmed rapid start, will start at minimum 0 deg. C. (indoors) and minus 29 deg. C. (outdoors). Ballasts shall meet ANSI C62.41 Category A transient voltage protection requirements. PF shall be greater than .95, and shall meet FCC Class A specifications for EMI/RFI. The maximum case temperature will not exceed 70 deg. C.
  - 2.4.6. Ballasts for compact fluorescent lamps to be universal input type electronic with end-of-lamp sensing. PF shall be greater than .98, BF shall be greater than .98, THD < 10%. Ballasts shall meet FCC Class A specifications for EMI/RFI.
  - 2.4.7. Ballasts for HID lamps will be suitable for operation in 40 deg. C. temperatures, with a minimum starting temperature of minus 30 deg. C. at 90 % of line voltage. They shall be encapsulated in a steel enclosure. Insulation is to be Class H (minimum 180 deg. C.) vacuum impregnated with silica filled polyester compound. Coils are to be precision or bobbin wound. Sound rating is to be minimum class B. Continuous operation for 60,000 hours at maximum rated load and temperature. Ballast factor of 1.0, .95 minimum power factor, 1.8 minimum crest factor.
  - 2.4.8. Electronic dimming ballasts for T5 and T8 lamped fluorescent luminaires are to be compatible with lamp type and quantity and shall meet the following requirements:
    - .1 Dimming range from 100% to 1% illuminance level with continuous, flicker free output with ambient noise level  $\leq 27\text{dB}$  over the entire dimming range.
    - .2 Maximum lead length from ballast to lamp socket is seven feet for T-8 lamps, and 3 feet for T-5 lamps.
    - .3 PF > .95.
    - .4 BF  $\geq .85$ .
    - .5 THD < 10% at full light output.
    - .6 Lamp crest factor  $\leq 1.6$ .
    - .7 Inrush current to be internally limited to not exceed 3 amps at 347V or 7A at 120V.
    - .8 Preheating of lamp cathodes before applying arc voltage.
    - .9 Withstand 4000V surges as per ANSI C62.41.
    - .10 Improper line voltage and control wiring shall not damage ballast. Each ballast is to be tested at low, medium and high end of range by manufacturer.
    - .11 Meet FCC Class A specifications for EMI/RFI.
  - 2.4.9. Electronic dimming ballasts for compact fluorescent luminaires are to be compatible with lamp type and quantity and shall meet the following requirements:

- .1 Dimming range from 100% to 1% illuminance level with continuous, flicker free output over the entire dimming range.
  - .2 Maximum lead length from ballast to lamp socket is 3 feet.
  - .3 PF > .95.
  - .4 BF ≥ .93.
  - .5 THD < 10% at full light output.
  - .6 Lamp crest factor ≤ 1.6.
  - .7 Inrush current to be internally limited to not exceed 3 amps at 120V.
  - .8 Preheating of lamp cathodes before applying arc voltage.
  - .9 Withstand surges as per ANSI C62.41.
  - .10 Improper line voltage and control wiring shall not damage ballast. Each ballast is to be tested at low, medium and high end of range by manufacturer.
  - .11 Meet FCC Class A specifications for EMI/RFI.
  - .12 Minimum starting temperature of 10 deg. C.
- 2.4.10. Ballasts shall contain no PCB's and audible rating will be class A or better.
- 2.4.11. Racks are to be provided for remote ballasts.
- 2.4.12. Ballasts with unacceptable noise levels are to be replaced at no cost to the owner.
- 2.5. LUMINAIRES
- 2.5.1. All luminaires are to be complete with mounting brackets, transformers, supports, trims, louvers, lenses and other accessories as required to make luminaire operational and allow it to be installed in the respective location.
- 2.5.2. Luminaires shall be suitable for the environment where installed, include seals and gaskets, and corrosion resistant baked-on finish as required and as specified.
- 2.5.3. Louvers, lenses and diffusers must be of suitable thickness to prevent sagging.
- 2.5.4. Where drawings show luminaires mounted end-to-end, luminaires shall be suitable for continuous, seamless and tandem mounting.
- 2.5.5. Fluorescent luminaires designed for continuous, seamless and tandem mounting shall only be constructed with four foot lamps. Two and three foot lamps are not acceptable unless indicated on drawings or luminaire schedule.
- 2.5.6. All poles are to come complete with internal vibration dampeners to accommodate wind conditions to avoid damage due to wind-induced vibrations.
- 2.5.7. All concrete bases for poles and bollards shall be designed to accommodate the height, weight, etc. of the pole/bollard and its accessories for the soil conditions for which it is installed. Engineered shop drawings shall be provided that is signed by a structural engineer registered in the local jurisdiction.
- 2.5.8. Where cameras are shown to be installed on poles, the poles shall be stiffened to reduce vibration and sway, and shall be rated for video recording cameras.
- 2.5.9. The supply and installation of fixed per unit cost and 'cash allowance' luminaires shall comply with all standards set forth in Electrical Specifications. Electrical Contractor is responsible to include in the base bid for delivery, scheduling, receiving, storage, partial assembly, installation, wiring, aiming, cleaning and warranties for all fixed per unit cost and 'cash allowance' luminaires.
- 2.5.10. The following is a list of generic type designation for luminaires. The project specific luminaire schedule is to be referenced for the specific types and designations and the respective specifications.

- .1 Designations beginning with the letter 'C' denote compact fluorescent type.
- .2 Designations beginning with the letter 'D' denote incandescent or halogen type.
- .3 Designations beginning with the letter 'F' denote fluorescent type.
- .4 Designations beginning with the letter 'H' denote high intensity discharge type.
- .5 Designations beginning with the letter 'L' denote LED type.
- .6 Designations beginning with the letter 'J' denote Induction type.
- .7 Designations beginning with the letter 'X' denote exit sign.

### 3. Execution

#### 3.1. INSTALLATION

- 3.1.1. It is the responsibility of the contractor to obtain the information related to the luminaire and luminaire trim finishes/colours from the Interior Designer or Architects prior to the fabrication of luminaires. The Contractor shall provide adequate time for the design team to review and comment on luminaire and luminaire trim finishes
- 3.1.2. The contractor will provide, receive, unload, uncrate, store, protect and install lamps, luminaires, and other related lighting equipment as specified herein. Lamps for all equipment will be provided and installed by the contractor according to equipment manufacturer's instructions.
- 3.1.3. The Electrical Contractor shall be responsible for the supply and installation of all concrete bases for poles and bollards. Unless otherwise shown on the drawings, concrete bases to be ArtForm style or Approved Equal and shall extend a minimum 900mm above grade in parking lots and a minimum 150mm above grade in pedestrian walkways.
- 3.1.4. Poles and bollards are to be installed on independent concrete bases unless indicated otherwise on the drawings or schedules. Coordinate brackets for cameras and supports for banners with pole manufacturer.
- 3.1.5. Install remote ballasts in racks and wire luminaires to ballasts in conduit. Provide wiring as per manufacturer's recommendations.
- 3.1.6. Locate luminaires in accordance with the Architect's Drawings. Coordinate exact locations on site. Refer to Architect's drawings for dimensions of coves and valences. Fluorescent staggered coves must have a minimum of two inches overlap.
- 3.1.7. Install in accordance with Manufacturer's Instructions, Local Codes, Electrical Division Drawings and Specifications.
- 3.1.8. All suspended luminaires shall have cables and support stems vertically aligned.
- 3.1.9. Suspend luminaires in mechanical rooms after all the mechanical equipment and ductwork are installed. Luminaires are not to be suspended from mechanical pipes, ductwork or other building services.
- 3.1.10. All luminaires shall be installed underneath other services located within ceiling space. Contractor is responsible for interference drawings to ensure all services in ceiling are coordinated.
- 3.1.11. Any dimensions provided in the drawings or schedules are intended as general guidelines. For exact dimensioning refer to the Architectural drawings. The detailed information shall be cross referenced with the electrical specifications and the Luminaire Schedule applying the most stringent requirement.
- 3.1.12. It is the responsibility of the Electrical Contractor to coordinate luminaire trims and mounting system with ceiling finishes. Luminaires delivered on site with the wrong ceiling mounting

system shall be replaced without additional costs for the owner. Restocking fees will not be accepted.

- 3.1.13. For suspended ceiling installations support luminaires from structural slab in accordance with local inspection requirements.
- 3.1.14. Where luminaires are mounted in tandem, align luminaires mounted in continuous rows to form straight uninterrupted line.
- 3.1.15. Align luminaires mounted individually parallel or perpendicular to building grid lines.
- 3.1.16. Ensure light leakage does not occur from openings and trim rings. Contractor is responsible to repair the ceiling at no cost to the Owner if cut-out is too large.
- 3.1.17. Connect luminaires to lighting circuits.
- 3.1.18. Provide all wiring in conduit with junction boxes on a grid pattern to limit the run of flexible armoured cable drops from the ceiling mounted junction box to each luminaire to a maximum of 3 m in length unless approved otherwise in writing from the Engineer's Representative.
- 3.1.19. Modular wiring systems shall be employed only where indicated or with approval of the Engineer's Representative.
- 3.1.20. Luminaires are not to be used as temporary construction lighting. After being tested to ensure acceptable operation, luminaires will not be used until substantial completion unless permission is received from the owner, architect or Engineer's Representative.
- 3.1.21. Lamps are to be installed after luminaire is cleaned. All fluorescent lamps shall be run through a minimum of 12 hours initial start to increase the lamp life and all lamps shall be run through a minimum of 100 hours initial start prior to any dimming.
- 3.1.22. Clean all luminaires, inside and out at time of substantial completion. Replace all scratched or damaged luminaires, lenses, louvers and diffusers at no cost to the owner.
- 3.1.23. Installation of exit signs
  - .1 Rough-in and installation of exit signs shall be carefully coordinated on site such that after installation of all equipment/services, including equipment/services from other trades (i.e. sprinkler lines, plumbing pipes, way-finding signs, etc.), shall not interfere with the line-of-sight visibility of the exit sign(s) from approach of the intended egress pathway(s).
  - .2 If exit sign(s) have been installed and do not meet the satisfaction of the Engineer's Representative/Architect, the Contractor shall lower, raise or relocate the exit sign(s) such that proper and adequate visibility of the exit sign(s) is achieved at no additional cost to the Owner.

END OF SECTION

1. General

1.1. WORK INCLUDED

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

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

1.1.3. Section 26 05 21.00 – WIRE AND CABLES 1000V.

1.1.4. Section 26 05 34.00 – CONDUITS, CONDUIT FASTENERS AND FITTINGS.

1.2. REFERENCES

1.2.1. CSA Standard C22.2 No.141 – Emergency Lighting Equipment, latest edition.

1.3. SHOP DRAWINGS AND PRODUCT DATA

1.3.1. Submit Shop Drawings and product data in accordance with Section 26 05 04.00 – SUBMITTALS/SHOP DRAWINGS

1.3.2. Submit shop drawings for equipment and accessories specified in this Section. Include photometric data for all luminaires not named as approved in this specification.

1.3.3. Data to indicate system components, mounting method, source of power and special attachments.

1.3.4. Manufacturer/Contractor to ensure runtime capacity of battery unit is sized accordingly to meet the runtimes specified within this section and/or drawings/schedules.

1.4. WARRANTY

1.4.1. For batteries, the warranty period shall be extended to 120 months, with a no-charge replacement during the first 5 years and a pro-rata charge on the second 5 years.

2. Products

2.1. EQUIPMENT

2.1.1. Supply voltage: 120 V, ac.

2.1.2. Output voltage: 24 V dc.

2.1.3. Operating time: 120 minutes, unless otherwise noted in schedules.

2.1.4. Battery: 10 year sealed, valve regulated, lead calcium.

2.1.5. 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. Recharges battery within 24 hours in accordance with CSA.

2.1.6. Solid state transfer circuit.

2.1.7. Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

2.1.8. Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

2.1.9. Lamp heads: integral on unit and remote as indicated, 345 horizontal and 180 vertical adjustment. Lamp type: MR16, wattage to be 50W unless noted otherwise on drawings or in the "Battery Unit Schedule" (i.e. 35W, 50W).



- 2.1.10. Directional remote head lamps to have narrow beam spread distribution.
- 2.1.11. Recessed remote head lamps to have flood beam spread distribution.
- 2.1.12. 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.
- 2.1.13. Finish: Baked white enamel.
- 2.1.14. 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 Bracket.
  - .8 Cord and single twist-lock plug connection for ac.
  - .9 RFI suppressors.
- 2.2. WIRING OF REMOTE HEADS AND EXIT SIGNS
  - 2.2.1. Conduit: As per Section 26 05 34.00 – CONDUITS, CONDUIT FASTENERS AND FITTINGS.
  - 2.2.2. Conductors: As per Section 26 05 21.00 – WIRE AND CABLES 1000V, sized as per manufacturer's recommendation and compliant to the applicable electrical codes.
- 3. Execution
  - 3.1. INSTALLATION
    - 3.1.1. Install unit equipment and remote mounted fixtures. Interconnect all heads with central battery pack.
    - 3.1.2. Direct heads to optimize illumination of egress pathways to minimum building code requirements.
    - 3.1.3. Connect exit lights to unit equipment.
    - 3.1.4. Contractor is to include the supply and installation of one additional head or an additional 5% of the total number of heads shown on the drawings, whichever is greater in the bid price. The installation is to include all wiring and conduit required to install the heads. If the heads are not installed during construction then the spare heads are to be turned over to the Owner at the end of the project.
  - 3.2. TESTING AND COMMISSIONING
    - 3.2.1. Contractor shall commission and test the entire system and adjust as necessary.
    - 3.2.2. Trip breaker(s) feeding battery unit(s) to simulate power failure to building. Test the operation of each unit to document the duration of runtime. Testing shall be performed during non-daylight hours.
    - 3.2.3. Inform Engineer's Representative 10 days in advance prior to testing being performed in order for Engineer's Representative to make arrangements to witness testing of emergency lighting system.

- 3.2.4. Provide Engineer's Representative with signed test report by Contractor that each unit successfully operated for the required duration of time.
- 3.2.5. Re-test voltage of battery units 24 hours after initial testing to verify rated nominal voltage of unit. If battery unit has not recharged properly, replace unit and re-test as stated above at no additional cost to Owner.

END OF SECTION

1. General
2. General
  - 2.1. WORK INCLUDED
    - 2.1.1. Conform to Section 16010 – GENERAL INSTRUCTIONS FOR ELECTRICAL SECTIONS.
  - 2.2. REFERENCES
    - 2.2.1. CAN/ULC-S524, Installation of Fire Alarm Systems – latest edition.
    - 2.2.2. CAN/ULC-S536, Inspection and Testing of Fire Alarm Systems – latest edition.
    - 2.2.3. CAN/ULC-S537, Verification of Fire Alarm Systems – latest edition.
    - 2.2.4. OBC - Ontario Building Code – latest edition.
    - 2.2.5. CAN/ULC-S1001 - Integrated Systems Testing of Fire Protection and Life Safety Systems – latest edition.
  - 2.3. SYSTEM DESCRIPTION AND INSTALLATION
    - 2.3.1. The fire alarm system and devices shall be installed according to CAN-CSA latest edition and the requirements of the local authorities having jurisdiction.
    - 2.3.2. All wiring shall be installed in conduit and to conform to the requirement of the Ontario Electrical Safety Code, 25th edition or local code having jurisdiction. Provide a ground wire in all conduits.
    - 2.3.3. Confirm the exact location of all system components with the architectural consultant prior to roughing-in.
    - 2.3.4. Contract base building fire alarm contractor to install all devices and make final connections to fire alarm panel.
    - 2.3.5. Ensure that the nomenclature of annunciator's identification nameplates, are verified with the owner and authorities prior to ordering.
    - 2.3.6. All work on the fire alarm system to be performed by a certified fire alarm technician.
    - 2.3.7. When the fire alarm system is complete, obtain the services of base building fire alarm manufacturer to make a complete inspection and verifications of all installed fire alarm equipment and devices.
    - 2.3.8. Perform any changes necessary as a result of the above verification and inspection in accordance with the manufacturer's directions.
    - 2.3.9. On completion of the verification, inspection and testing obtain the verification certificate and inspection reports from the manufacturer and forward to the owner.
    - 2.3.10. Fire alarm signaling devices to be installed and tested in compliance with Ontario Building Code (latest edition) section 3.2.4.20. (audibility).
      - .1 For speakers, set at 0.5 watt tap and modify up if required to achieve audibility. Tap setting shall not be set at or increased to cause the sound pressure level to be more than 100 dBA when measured 3m from the device.
      - .2 For horns with adjustable volume settings, set at mid volume and modify up if required to achieve audibility. Volume setting shall not be set at or increased to cause the sound pressure level to be more than 100 dBA when measured 3m from the device.

Audibility testing shall be performed with all walls, windows, ceilings, ceiling tiles, etc. installed in the space/area. If audibility is determined to be insufficient at time of occupancy, the Contractor shall be responsible for all costs associated with increasing the tap settings of the signalling device to achieve Code minimum audibility. Include for all costs in tender.

2.3.11. Ensure that all costs for the above testing, verification, inspection are included in the tender price.

2.3.12. Where the integrity of the existing life safety input and output devices are affected due to relocations, ceiling demolitions and/or re-installations onto new suspended ceiling, electrical contractor shall be responsible to maintain the system operation at all times. All suspension accessories required for the installation (e.g., mounting channels and frames, etc.) and verification of the system shall be included in the tender prices.

2.3.13. Testing and commissioning of the integration of all life safety and fire protection systems shall be required. Follow the guidelines as outlined in the CAN/ULC-S1001 standard. Where applicable, the testing of the integrated systems shall include, but not limited to the following systems:

.1 Fire Alarm

The Contractor shall be responsible for performing and providing a commissioning report of all the applicable systems installed, that they have been tested as a whole to ensure the proper operation and inter-relationship between the systems. Include for all costs in the tender prices.

END OF SECTION

Audibility testing shall be performed with all walls, windows, ceilings, ceiling tiles, etc. installed in the space/area. If audibility is determined to be insufficient at time of occupancy, the Contractor shall be responsible for all costs associated with increasing the tap settings of the signalling device to achieve Code minimum audibility. Include for all costs in tender.

2.3.11. Ensure that all costs for the above testing, verification, inspection are included in the tender price.

2.3.12. Where the integrity of the existing life safety input and output devices are affected due to relocations, ceiling demolitions and/or re-installations onto new suspended ceiling, electrical contractor shall be responsible to maintain the system operation at all times. All suspension accessories required for the installation (e.g., mounting channels and frames, etc.) and verification of the system shall be included in the tender prices.

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END OF SECTION

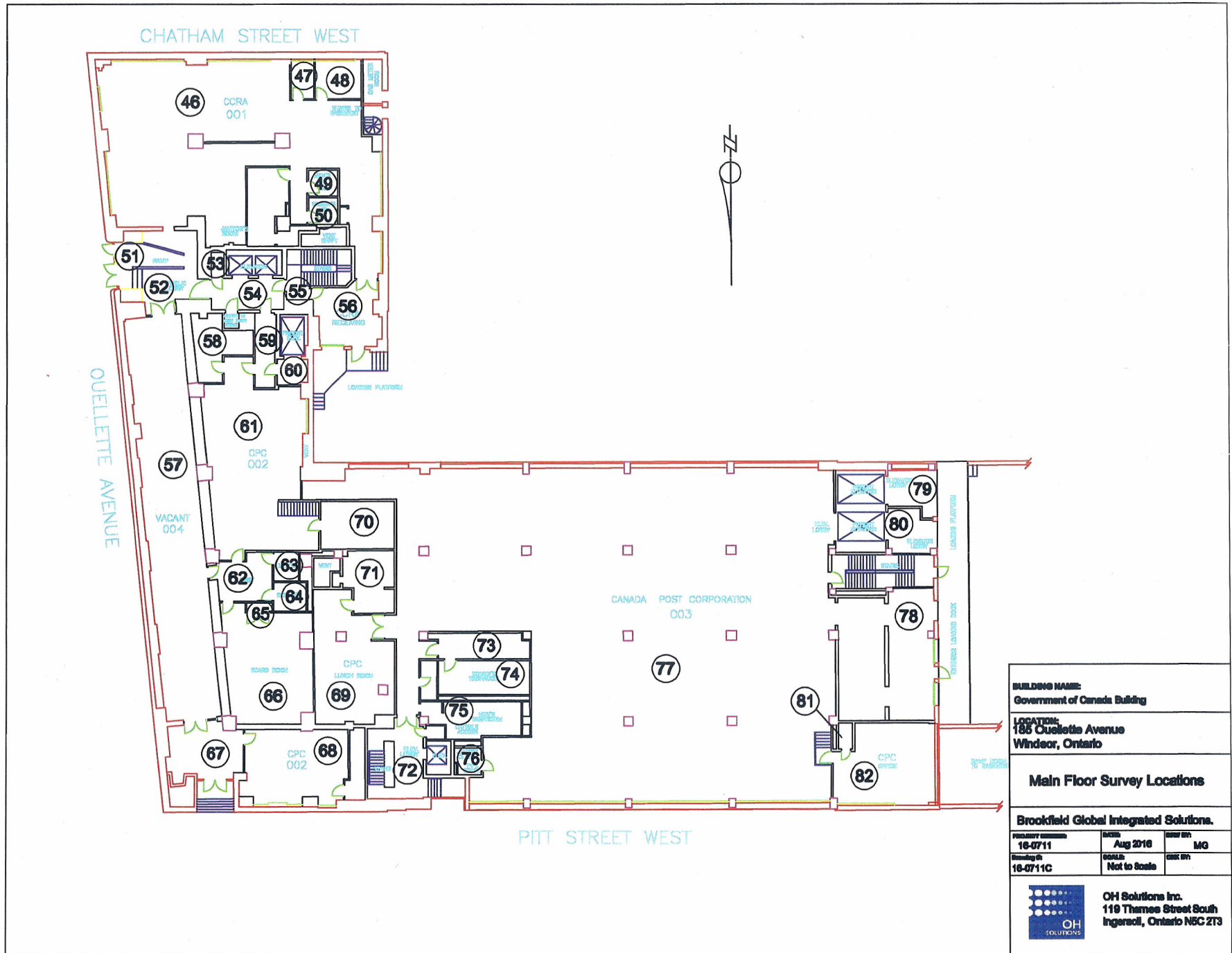
<b>PANEL: RP-1H</b> PROJECT NAME: PWGSC - WINDSOR PROJECT #: 17066.001	LOCATION: open Office 01-00  FED FROM: SDP-02	<b>Smith + Andersen</b> 
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TYPE/ INFO	DESCRIPTION	D.F [%]	CONN. LOAD [W]	DEMAND LOAD [W]	BKR [A]	CCT NO.	Φ	CCT NO.	BKR [A]	DEMAND LOAD [W]	CONN. LOAD [W]	D.F [%]	DESCRIPTION	TYPE/ INFO
	Open Office Receptacles	70	600	420	15	1	A	2	25	1456	2080	70	CU-2 (2#10+1#12 BND in 3/4" C)	
	Open Office Receptacles	70	600	420	15	3	B	4	2P	1456	2080	70		
	Change Room	70	800	560	15	5	C	6	20	1107	1581	70	CU-1 (2#12+1#12 BND in 3/4" C)	
	Copy Room	70	400	280	15	7	A	8	2P	1107	1581	70		
	Copy Room printer	70	1000	700	20	9	B	10	15	245	350	70	EF-1	
	IT Closet Recptacles	70	1000	700	20	11	C	12	45	2800	4000	70	Humidifer (2#8+1#10 BND in 1"C)	
	IT Closet Recptacles	70	1000	700	20	13	A	14	20	280	400	70	Exterior Recptacles	
	IT Closet Recptacles	70	1000	700	20	15	B	16	20	560	800	70	Over counter recptacle	
	Space				15	17	C	18	15				Space	
	Space				15	19	A	20	15				Space	
	Space				15	21	B	22	15				Space	
	Space				15	23	C	24	15				Space	
	Space				15	25	A	26	15				Space	
	Space				15	27	B	28	15				Space	
	Space				15	29	C	30	15				Space	
	Space				15	31	A	32	15				Space	
	Space				15	33	B	34	15				Space	
	Space				15	35	C	36	15				Space	
	Space				15	37	A	38	15				Space	
	Space				15	39	B	40	15				Space	
	Space				15	41	C	42	15				Space	

<b>PANEL OPTIONS:</b>				LOAD A [KW]:	4.24	PHASE VOLTAGE [V]:	120
<input checked="" type="checkbox"/> 2	:CSA ENCLOSURE RATING	<input type="checkbox"/>	FLUSH	LOAD B [KW]:	4.08	LINE VOLTAGE [V]:	208
<input type="checkbox"/>	FEED THROUGH	<input checked="" type="checkbox"/>	SURFACE	LOAD C [KW]:	5.17	PHASE:	3Φ
<input type="checkbox"/>	SUB-FEED	<input checked="" type="checkbox"/>	BOLT-ON BREAKER	TOTAL [KW]:	13.5	WIRE:	4
<input type="checkbox"/>	MAIN BREAKER	<input type="checkbox"/>	SPD			MAINS [A]:	225
<input type="checkbox"/>	200% RATED NEUTRAL BUS	<input type="checkbox"/>		CURRENT A [A]:	35	MAIN BREAKER [A]:	80
<input type="checkbox"/>	ISOLATED GROUND BUS	<input type="checkbox"/>		CURRENT B [A]:	34	I.C. [kA]:	10
				CURRENT C [A]:	43		

<b>LEGEND:</b>			<b>NOTES:</b>
BAS-Building Automation System	R.C-Relay Controlled	LTS-Lighting	1. Panel Enclosure To Be Sprinklerproof. 2. Panels greater than 66 circuits to be double tub.
GFCI-Ground Fault Circuit Interrupter	M-Motor	HID-High Intensity Discharge	
AFCI-Arc Fault Circuit Interrupter	D.F-Demand Factor	Lighting Breaker	
SPD - Surge Protection Device	REC-Receptacle	D.C-Direct Connection	
BLO-Breaker Lock-On Device			

<u>Section</u>	<u>Title</u>	<u>Pages</u>
00 00 00	APPENDIX A	
	<u>INCLUDED</u>	
	Partial Report of: (Full report available upon request)	5
	<u>Asbestos Product Re-Assessment</u>	
	GOVERNMENT OF CANADA BUILDING	
	185 Ouellette Avenue	
	Windsor, Ontario Complex #500184	
	Prepared for:	
	Brookfield GIS,	
	c/o PWGSC 4175 14th Avenue PO BOX 4870 Markham, ON L3R 0J2	
	September 26th, 2016	
	Prepared by:	
	OH Solutions Project No.: 16-0711	
	<u>Designated Substances Assessment</u>	39
	GOVERNMENT OF CANADA BUILDING	
	185 Ouellette Avenue	
	Windsor, Ontario Building#5520060	
	Prepared for:	
	SNC Lavalin O&M	
	441 University Avenue West, Suite 212, Windsor, ON N9A 5P9	
	December 20 <sup>th</sup> , 2012	
	Prepared by:	
	OH Solutions Project No.: 12-030	
	<u>Lead Paint Sampling-</u>	4
	185 Ouellette Avenue- Windsor, Ontario	
	March 12 <sup>th</sup> , 2017	
	Prepared by:	
	OH Solutions Project No.: 17-1048	



BUILDING NAME: Government of Canada Building		
LOCATION: 185 Ouellette Avenue Windsor, Ontario		
Main Floor Survey Locations		
Brookfield Global Integrated Solutions.		
PROJECT NUMBER: 16-0711	DATE: Aug 2016	DRAWN BY: MG
DRAWING NO: 16-0711C	SCALE: Not to Scale	CHECK BY:
 OH SOLUTIONS INC. 119 Thames Street South Ingersoll, Ontario N5C 2T3		



# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = '16-0711'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Duct	Uninsulated								
Floor	Ceramic Tile								
Mechanical	Inaccessible								
Piping	Fibreglass Straight Run								
Piping	Horsehair								
Piping	Non-Asbestos Cellulose Straight Run								V101
Piping	Uninsulated								
Structure	Concrete Beam, Deck								
Wall	Ceramic Tile								
Wall	Non-Asbestos Plaster								V01

**Comments:** Limited access above ceiling.

<b>Level :</b> 1 - First Floor		<b>Room :</b> LOC 76 - Custodial Closet			<b>Asbestos Present :</b> Potentially				
Ceiling	Non-Asbestos Plaster								V01
Duct	Inaccessible								
Floor	Terrazzo								
Mechanical	Inaccessible								
Piping	Inaccessible								
Structure	Inaccessible								
Wall	Non-Asbestos Plaster								V01

**Comments:** No access above ceiling.

<b>Level :</b> 1 - First Floor		<b>Room :</b> LOC 77 - Mail Room			<b>Asbestos Present :</b> Yes				
Ceiling	Asbestos Texture Finish (Coat)	4,000.0	SF	Good	C	7	Yes	Yes	

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = '16-0711'

Registered User: OH Solutions Inc.

Design	Description	Quantity		Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Duct	Inaccessible									
Floor	Non-Asbestos Vinyl Tile - New									
Floor	Terrazzo									
Mechanical	Radiator									
Piping	Asbestos Mag-Block Straight Run	200.0	LF	Good	Chrysotile 8.00% Crocidolite 2.00%	D	7	No	Yes	V102
Piping	Asbestos Parging Cement Fittings	50.0	APPX	Good	Chrysotile 35.00%	D	7	No	Yes	V100
Piping	Fibreglass Straight Run									
Piping	Horsehair									
Piping	Uninsulated									
Structure	Inaccessible									
Wall	Drywall - No Joint Compound									
Wall	Masonry									
Wall	Non-Asbestos Plaster									V01

**Comments:** No access above ceiling.

Viewing catwalk above  
ACM in perimeter heating lines in bulkhead

**Level :** 1 - First Floor

**Room :** LOC 78 - Loading Dock

**Asbestos Present :** Potentially

Ceiling	Non-Asbestos Rough Plaster									V104
Duct	Uninsulated									
Floor	Concrete									
Mechanical	Heat Unit									
Piping	Fibreglass Straight Run w/ PVC									
Structure	Inaccessible									

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = '16-0711'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Wall	Non-Asbestos Drywall Compound - New								
<b>Comments:</b>									
Recently renovated									
<b>Level : 1 - First Floor</b>		<b>Room : LOC 80 - Elevator Lobby</b>			<b>Asbestos Present : No</b>				
Ceiling	Non-Asbestos Rough Plaster								V104
Duct	Uninsulated								
Floor	Concrete								
Mechanical	Heat Unit								
Piping	Fibreglass								
Piping	Uninsulated								
Structure	Concrete Beam, Deck								
Wall	Masonry								
<b>Comments:</b>									
Recently renovated									
<b>Level : 1 - First Floor</b>		<b>Room : LOC 81 - Storage Room</b>			<b>Asbestos Present : Yes</b>				
Ceiling	Asbestos Texture Finish (Coat)	30.0	SF	Good	C	7	Yes	Yes	
Duct	Inaccessible								
Floor	Concrete								
Floor	Terrazzo								
Mechanical	Inaccessible								
Piping	Inaccessible								
Structure	Inaccessible								

# Asbestos Status Report

(sorted by Building Number)

UPPER(BUILD:BuildingNumber) = '16-0711'

Registered User: OH Solutions Inc.

Design	Description	Quantity	Cond.	Asbestos type	Access.	Action	Visible	Friable	Sample
Wall	Masonry								
Wall	Non-Asbestos Plaster								V01
Comments: No access above ceiling.									
Level : 1 - First Floor		Room : LOC 82 - Office			Asbestos Present : Yes				
Ceiling	Asbestos Texture Finish (Coat)	500.0 SF	Good		C	7	Yes	Yes	
Duct	Inaccessible								
Floor	Carpet								
Floor	Terrazzo								
Mechanical	Radiator								
Piping	Uninsulated								
Structure	Inaccessible								
Wall	Masonry								
Wall	Non-Asbestos Plaster								V01
Wall	Wood								
Comments: No access above ceiling.									
Level : 2 - Second Floor		Room : LOC 083 - Office			Asbestos Present : Yes				
Ceiling	Asbestos Texture Finish (Coat)	25.0 SF	Good		D	7	No	Yes	
Ceiling	Non-Asbestos Drywall Compound - New								
Ceiling	Non-Asbestos Lay-in Tile - New								
Ceiling	Non-Asbestos Plaster								V25
Duct	Uninsulated								



## **DESIGNATED SUBSTANCES ASSESSMENT**

## **GOVERNMENT OF CANADA BUILDING**

185 Ouellette Avenue  
Windsor, Ontario  
Building #5520060

Prepared for:

**SNC Lavalin O&M**  
**441 University Avenue West, Suite 212**  
**Windsor, Ontario**  
**N9A 5P9**

December 20<sup>th</sup>, 2012

OHS Project No.: 12-030

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## APPENDICES

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## 1.0 INTRODUCTION

OH Solutions Inc (OHS) was retained by SNC Lavalin O&M to conduct a Designated Substances Assessment within 185 Ouellette Avenue in Windsor, Ontario (the Site).

This report was prepared to fulfil an Owner's requirements under Section 30 of the Ontario Occupational Health and Safety Act (as amended). Prior to tendering project work in buildings, the building owner or owner's agent must provide this report to constructors. The successful constructor must then provide this document to all future subcontractors prior to accepting bids.

"Designated Substance" as defined by the Ontario *Occupational Health & Safety Act* (OHSA) means "a biological, chemical or physical agent or combination thereof prescribed as a Designated Substance to which the exposure of a worker is prohibited, regulated, restricted, limited or controlled." Designated Substances include the following; asbestos, acrylonitrile, arsenic, benzene, coke oven emissions, ethylene oxide, isocyanates, lead, mercury, silica and vinyl chloride.

The sections below explain our survey methodology and summarize the Designated Substances found at the Site.

## 2.0 SURVEY METHODOLOGY

A thorough room by room inspection/walkthrough of all areas of the facility suspected of containing designated substances was conducted. Materials suspected of containing designated substances were visually identified, based on the surveyor's knowledge of the historic composition of building products. While on site OHS personnel conducted the following:

- Characterization the existing building data;
- Determined the approximate quantities, location and condition of accessible Designated Substances and;
- Conducted sampling of representative building materials and finishes

For the purposes of this assessment, OHS targeted the following Designated Substances:

- Lead
- Mercury
- Silica (free crystalline)

Sampling for both friable and non-friable suspected asbestos-containing materials has been previously conducted at this facility and therefore has not been included as part of this assessment. Please refer to the Asbestos Building Product Surveys for information regarding building products containing asbestos at this facility.

Concealed locations within the building such as areas above plaster or drywall ceilings, chases and bulkheads were not included as part of the assessment.

OHS collected visually distinct paint samples suspected of containing lead. Where possible, OHS removed all layers of paint down to the buildings components unpainted surface.

Several samples of suspected lead-containing paint samples were collected and subsequently submitted for analysis. The suspected lead-containing paints were analyzed using flame atomic absorption spectroscopy (F.A.A.S.). OHS has included samples collected during previous assessments.

OHS submitted samples of suspected asbestos-containing lead paint to International Asbestos Testing Laboratories (IATL) of Mt. Laurel, New Jersey, USA.

All other designated substances were identified based on visual assessment and historical usage.

In addition to Designated Substances, OHS scope of work included the identification of PCBs in florescent light fixtures. OHS visually inspected random fixtures/ballasts and compared model numbers, serial numbers and date codes to Environment Canada Report EPS 2/CC/2 (revised) August 1991 - Identification of Lamp Ballasts Containing PCB's.

### **3.0 REGULATORY REQUIREMENTS**

As outlined above, under Section 30 of the Occupational Health and Safety Act, the intent of this assessment is to fulfil the owner requirements to determine whether any Designated Substances are present at a project site during tendering and/or before beginning construction.

Designated Substances are regulated under Ontario Regulation 490/09. This regulation outlines the occupational exposure limits (OELs) for each Designated Substance. While construction projects are generally exempt, the OELs establish an Ontario standard for worker protection.

In addition to Ontario Regulation 490/09, Asbestos is regulated under O. Reg. 278/05, Asbestos on Construction Projects and in Buildings and Repair Operation, as



amended. Disposal of asbestos waste is subject to waste management regulations under Ontario Regulation 347/90 as amended.

The MOL does not have a standard to state what percentage of lead or silica a material must have to be considered lead or silica-containing. Procedures that provide an equivalent level of protection should, therefore, be implemented on construction projects where exposure to lead and silica is possible.

The Ministry of Labour has issued drafted guidelines for control of lead and silica exposures on construction projects. The Guideline for Lead on Construction Projects and the Guideline for Silica on Construction Projects should be adhered to during construction projects in order to protect the health and safety of workers.

The Federal Chlorobiphenyls Regulation, SOR/91-152 prohibits the use of PCBs in electrical transformers, capacitors and associated electrical equipment manufactured in or imported into Canada after July 1, 1980. The Federal Chlorobiphenyls Regulation SOR/92-507 and Ontario Regulation 362/90 outline the handling, storage and disposal of PCBs and PCB-containing equipment.

## **4.0 RESULTS**

The Site is a six-story building with a sub-basement, basement and partial penthouse. The building has a total footprint of approximately 10,900 square metres and appears to have been originally constructed in 1933. A large addition was constructed to the south of the original building in 1959. Building drawings have been included within Appendix III.

### ***4.1 Asbestos-Containing Materials***

Please refer to the asbestos survey(s) for information regarding products suspected to contain asbestos within the building.

## 4.2 Lead

Paint samples were collected and subsequently submitted for laboratory analysis. Lead paint concentrations range from none detected to 4.3%. Previously and newly collected lead bulk samples have been included within Appendix A. A summary of the sampling is outlined below:

Sample #	Location	% Lead
2012 OHS Samples		
P1	Sub Basement -Silver Paint	0.097
P2	Sub Basement –Yellow Paint	0.36
P3	Upper Penthouse - Grey With Red Back Floor Paint	0.041
P4	6 <sup>th</sup> Floor East Central - Column Paint Northend Beige	1.2
P5	5 <sup>th</sup> Floor - Ivory Paint	0.12
P6	Light Green Paint Under Beige – Columns	0.26
P7	Yellow/Taupe Column - 3 <sup>rd</sup> Floor	0.28
P8	Yellow/Taupe Column - 3 <sup>rd</sup> Floor	0.15
P9	3 <sup>rd</sup> Floor Ceiling Beige - On Plaster	0.22
P10	2 <sup>nd</sup> Floor Beige Freight Elevator - Green Behind	3.4
P11	2 <sup>nd</sup> Floor White AHU - Plaster Paint	<0.0069
P12	Loading Dock CPC White	<0.0049
2008 Samples		
L-01	General White Paint – Location 08 – Mechanical Room	<0.0252
L-02	Grey Floor Paint – Location 08 – Two layers.	0.3006
L-03	White Paint on Walls/Ceiling – Location 13 - Corridor	<0.0134
L-05	Red Paint on Floor – Location 26 – CPC Storage	0.7076
L-06	Green Paint on Wall – Location 26 – CPC Storage	0.9829
L-08	Green Paint on Duct, Pipe, and Structure – Location 40 – Parking Garage	0.1717
L-10	Brown Paint on Doors/Jams – Location 41 – Elevator Lobby	1.8962
L-11	Green Paint on Steel Beam – Location 273 – Upper Penthouse	0.2054
L-12	Beige Paint on Window Liner – Location 273 – Upper Penthouse	0.1962
L-13	Black Window Trim Paint – Location 273 – Upper Penthouse	4.3355
L-14	Beige Ceiling Paint – Location 228 – Mechanical Room	0.7256
L-15	Brown Base Coat – White Overcoat – Location 253 – Sixth Floor	1.9472
L-16	Green Paint on Plaster – Location 209	0.2505
L-17	Beige Paint on Wall – Location 241 - Office	0.1297

Sample #	Location	% Lead
L-18	Beige Paint on Wall – Location 217 – File Room	0.1604
L-19	Beige Paint on Structural Steel – Location 244 – Elevator Penthouse Mechanical	0.6847

Lead is also suspected to be a component of the following:

- Solder on copper plumbing fixtures
- Mortar at brick veneer
- Lead wool or caulking in bell/spigot fittings on cast iron piping systems
- Lead-acid batteries

Sampling of the above was not conducted.

#### **4.3 Mercury**

Mercury is present in fluorescent light tubes. OHS did not observe any thermostats containing mercury however may be present within boiler and air handling unit control equipment.

#### **4.4 Silica**

Common construction sand contains free crystalline silica will be present in concrete products, mortar, brick, etc found throughout building structures.

#### **4.5 Acrylonitrile, Benzene, Isocyanates, Arsenic, Ethylene Oxide, Vinyl Chloride and Coke Oven Emissions**

The presence of acrylonitrile, benzene, isocyanates, arsenic, ethylene oxide, vinyl chloride monomer or coke oven emissions are not expected at the Site.

#### **4.6 Polychlorinated Biphenyls (PCB)**

Florescent light ballasts are present in various locations within the facility. The building has undergone a lighting retrofit within the last few years. Of the ballasts inspected, none were suspected to contain PCB's.

### **5.0 RECOMMENDATIONS**

Asbestos-containing materials have been previously identified within the facility and therefore the building is subject to the requirement for an Asbestos Management Program, as specified under Ontario Regulation 278/05. Please refer to the existing on-site Asbestos Management Program and Survey(s) for recommendations regarding asbestos at this facility.

### **5.1 Lead**

Lead is present in some painted surfaces and is suspected to be a component of solder on copper plumbing fixtures, mortar at brick veneer, wool or caulking in bell/spigot fittings on cast iron piping systems and within lead-acid batteries.

Elevated airborne lead levels can result when uncontrolled work procedures such as drilling, cutting, removing, grinding, etc. are used on lead-based materials. The control of dust levels during the demolition of the buildings can be accomplished through proper work practices to reduce overall dust levels and providing workers with proper personal protective equipment.

OHS recommends the work procedures and personal protective equipment outlined within the MOL document 'Guideline – Lead on Construction Projects' (2004) be utilized during the disturbance or handling of the material.

### **5.2 Mercury**

Mercury is present in florescent light tubes and may be present in may be present within boiler and air handling unit control equipment.

Exposure to airborne mercury is regulated under the Designated Substances regulation titled, *Ontario Regulation 490/09, Designated Substances*. Mercury waste must be handled and disposed of according to Ontario Regulation 347, as amended, and may be subject to Leachate Criteria (Schedule 4) of this regulation.

### **5.3 Silica**

Disturbance of materials containing silica will occur during demolition activities. Elevated airborne silica levels can result when uncontrolled work procedures such as drilling, cutting, removing, grinding, etc. are used on silica-containing materials.

OHS recommends the work procedures and personal protective equipment outlined within the MOL document 'Guideline – Silica on Construction Projects' (2004) be utilized during the disturbance or handling of the material.

## **6.0 LIMITATIONS AND WARRANTY**

OHS has prepared this report for the exclusive use of the Client in evaluating the Site at the time of OHS's assessment. OHS will not be responsible for the use of this report by any third party, or reliance on or any decision to be made based on it without the prior written consent of OHS. OHS accepts no responsibility for damages, if any, by any third party because of decisions or actions based on this report.

The findings contained in this report are based upon conditions as they were observed at the time of investigation. No assurance is made regarding changes in conditions subsequent to the time of investigation.

If new information is developed in future work, OHS should be contacted to re-evaluate the conclusions of this report and to provide amendments as required.

Respectfully submitted,

**OH Solutions Inc.**



Jeff Doherty, BSc  
Senior Occupational Hygienist

## **APPENDIX I**

### **LEAD SAMPLING RESULTS**

## CERTIFICATE OF ANALYSIS

<b>Client:</b>	O H Solutions	<b>Report Date:</b>	8/7/2012
	233 Mitchell Ave	<b>Report Number:</b>	281653
	Dorchester ON N0L 1G3	<b>Project:</b>	185 Ouellette
		<b>Project No.:</b>	12-030

### LEAD PAINT SAMPLE ANALYSIS SUMMARY

<u>Lab No.</u>	<u>Client No.</u>	<u>Location / Description</u>	<u>Concentration Lead By Weight (%)</u>
4739918	1	Silver Paint Sub-Basement	0.097***
4739919	2	Yellow Paint Sub-Basement	0.36*
4739920	3	Grey With Red Paint Upper Penthouse Floor	0.041
4739921	4	Beige Paint 6th Floor, East Central Column, NorthEnd	1.2
4739922	5	Ivory Paint 5th Floor	0.12***
4739923	6	Lt. Green Under Beige Paint Columns	0.26
4739924	7	Yellow/Taupe Paint 3rd Floor, Column	0.28
4739925	8	Yellow/Taupe Paint 3rd Floor, Column	0.15
4739926	9	Beige Ceiling Paint 3rd Floor, On Plaster	0.22
4739927	10	Beige Over Green Paint 2nd Floor, Freight Elevator	3.4

**Accreditations:** **NATIONAL LEAD LABORATORY ACCREDITATION PROGRAM (NLLAP)**  
AIHA-LAP, LLC No. 100188 NYSDOH-ELAP No. 11021

**Analytical Methods:** ASTM D3335-85A "Standard Method To Test For Low Concentrations Of Lead In Paint By Atomic Absorption Spectrophotometry"  
EPA SW846-(3050B:7000B) "Standard Method To Test For Low Concentrations Of Lead In Soils, Sludges and Sediments By AAS"

**Comments:** Regulatory limit is 0.5% lead by weight (EPA/HUD guidelines). Recommend multiple sampling for all samples less than regulatory limit for confirmation. All results are based on the samples as received at the lab. IATL assumes that appropriate sampling methods have been used and the data upon which these results are based have been accurately supplied by the client. Method Detection Limit (MDL) per EPA Method 40CFR Part 136 Appendix B. Reporting Limit (RL) based upon Lowest Standard Determined (LSD) in accordance with AIHA-ELLAP policies. LSD=0.2 ppm MDL=0.0044% by weight. RL= 0.010% by weight (based upon 100 mg sampled). \* Insufficient sample provided to perform QC reanalysis (<200 mg) \*\* Not enough sample provided to analyze (<50 mg) \*\*\* Matrix / substrate interference possible. Sample results are not corrected for contamination by field or analytical blanks. This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA or any government agency. This report shall not be reproduced except in full, without written approval of the laboratory.

**Date Received:** 7/31/2012  
**Date Analyzed:** 8/7/2012  
**Analyst:** C. Shaffer

**Approved By:** \_\_\_\_\_  
Frank E. Ehrenfeld, III  
Laboratory Director

## CERTIFICATE OF ANALYSIS

<b>Client:</b>	O H Solutions	<b>Report Date:</b>	8/7/2012
	233 Mitchell Ave	<b>Report Number:</b>	281653
	Dorchester ON N0L 1G3	<b>Project:</b>	185 Ouellette
		<b>Project No.:</b>	12-030

## LEAD PAINT SAMPLE ANALYSIS SUMMARY

<u>Lab No.</u>	<u>Client No.</u>	<u>Location / Description</u>	<u>Concentration Lead By Weight (%)</u>
4739928	11	White Paint	<0.0069***
		2nd Floor, AHU Plaster	
4739929	12	White Paint	<0.0049
		Loading Dock CPC	

**Accreditations:** **NATIONAL LEAD LABORATORY ACCREDITATION PROGRAM (NLLAP)**  
AIHA-LAP, LLC No. 100188 NYSDOH-ELAP No. 11021

**Analytical Methods:** ASTM D3335-85A "Standard Method To Test For Low Concentrations Of Lead In Paint By Atomic Absorption Spectrophotometry"  
EPA SW846-(3050B:7000B) "Standard Method To Test For Low Concentrations Of Lead In Soils, Sludges and Sediments By AAS"

**Comments:** Regulatory limit is 0.5% lead by weight (EPA/HUD guidelines). Recommend multiple sampling for all samples less than regulatory limit for confirmation. All results are based on the samples as received at the lab. IATL assumes that appropriate sampling methods have been used and the data upon which these results are based have been accurately supplied by the client. Method Detection Limit (MDL) per EPA Method 40CFR Part 136 Appendix B. Reporting Limit (RL) based upon Lowest Standard Determined (LSD) in accordance with AIHA-ELLAP policies. LSD=0.2 ppm MDL=0.0044% by weight. RL= 0.010% by weight (based upon 100 mg sampled). \* Insufficient sample provided to perform QC reanalysis (<200 mg) \*\* Not enough sample provided to analyze (<50 mg) \*\*\* Matrix / substrate interference possible. Sample results are not corrected for contamination by field or analytical blanks. This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA or any government agency. This report shall not be reproduced except in full, without written approval of the laboratory.

**Date Received:** 7/31/2012  
**Date Analyzed:** 8/7/2012  
**Analyst:** C. Shaffer



# Atomic Absorption Lead Report

Analysis Method: Lead in Paint analyzed by Atomic Absorption (AA)/SW-846-7420;  
This analysis is not covered by the scope of accreditation by NVLAP or AIHA.

Sample Prep Method: Samples are dissolved in nitric acid, extracted, and analyzed on a properly calibrated AA; Absorbency curve was calculated, bandwidth corrected, and wavelength at the time of the analysis was measured and recorded.

**Client Information:**  
Advanced Environmental  
Corp  
4093 Meadowbrook Drive,  
Unit 114  
London, Ontario N6L1G2

**Client Project:**  
SNC FED – 185 Ouelette  
08-4259

**CA Labs Project #:**  
CAL08085673

**Date:** 8/12/08 MP

**Phone:** 519-652-6105

**Turnaround Time:** 5 Day

**Samples Received:**  
8/7/08 10am

**Fax:** 519-652-1709

**Attn:**

**Purchase Order #:**

Sample#	Sample Concentration: parts per million (ppm)	Weight Percent:
---------	--	-----------------

01 White paint – Basement – Location 8 – Mechanical		< 252.21	< 0.0252
02 Gray floor paint – Location 8 – Mechanical – two layer		3006.45	0.3006
03 White paint on walls /ceiling – Location 13 – Corridor		< 134.05	< 0.0134
04 beige paint on doors/jam – Basement – Location 16	<i>Insufficient</i>	<i>Sample for</i>	<i>Analysis</i>
05 Red paint on Floor – Location 26 – CPC Storage		7075.53	0.7076
06 Green paint on wall – Location 26 – CPC Storage		9828.77	0.9829
07 Brown wall paint – Location 26 CPC Storage	<i>Insufficient</i>	<i>Sample for</i>	<i>Analysis</i>
08 Green paint on Duct, Pipes, and Structure – Location 40 – Parking Garage		1716.67	0.1717
09 Blue paint on Doors/Jams – Location 41 – Elevator Lobby	<i>Insufficient</i>	<i>Sample for</i>	<i>Analysis</i>
10 Brown Floor Paint – Staircase at Location 42		18961.56	1.8962
11 Green paint on steel beam – Location 273 – Upper Penthouse		2054.10	0.2054

NVLAP # 200349-0

Approved Signatories:

Henry Heiser  
Analyst

TDH # 30-0235

Page 1 of 3

Leslie Crisp  
Laboratory Director

Chad Lytle  
Senior Analyst

Notes:  
The current guidelines for lead in paint from the Consumer Products Safety Council (CPSC) is 0.06% by weight; the Housing and Urban Development (HUD) guideline is 0.5% by weight.

CA Labs is participating in ELPAT rounds sponsored by American Industrial Hygiene Association (AIHA) and National Lead Laboratory Program (NVLAP). This test report relates only to the items tested. This test reports relates only to the items tested. Neither AIHA, NVLAP nor EPA accreditation implies endorsement by any US Government agency. CA Labs is accredited by AIHA for fungi. This report may not be reproduced except in full without written permission from CA Labs.

These results are submitted pursuant to CA Labs' current terms and condition of sale, including the company's standard warranty and limitation of liability provisions and no responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified in writing to return the samples covered by this report, CA Labs will store the samples for a period of ninety (90) days before discarding. A shipping and handling fee may be assessed for the return of any samples.

Analysis performed at Crisp Analytical Labs, LLC 2081 Hutton Dr. Suite 301 Carrollton, TX 75006; phone (972) 488-1414, fax (fax) 488-8006, mobile (214) 564-8366.

# Atomic Absorption Lead Report

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4093 Meadowbrook Drive,  
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**Client Project:**  
SNC FED – 185 Ouelette  
08-4259

**CA Labs Project #:**  
CAL08085673

**Date:** 8/12/08 MP

**Phone:** 519-652-6105

**Turnaround Time:** 5 Day

**Samples Received:**  
8/7/08 10am

**Fax:** 519-652-1709

**Attn:**

**Purchase Order #:**

Sample#	Sample Concentration: parts per million (ppm)	Weight Percent:
12 Beige paint on window liner – Location 273 – Upper Penthouse	1961.51	0.1962
13 Black Window Trim Paint – Location 273 – Upper Penthouse	43355.41	4.3355
14 Beige ceiling paint – Location 228 Mechanical Room	7255.56	0.7256
15 Brown base coat – White overcoat – Location 253 – Sixth floor	19471.70	1.9472
16 Green paint on Plaster – Location 209	2504.92	0.2505
17 Beige Paint on Wall – Location 241 – Office	1297.06	0.1297
18 Beige Paint on Wall – Location 217 – File Room	1603.71	0.1604
19 Beige paint on structural steel – Location 244 – Elevator Penthouse Mechanical	6847.29	0.6847

NVLAP # 200349-0

Approved Signatories:

Henry Heiser  
Analyst

TDH # 30-0235

Page 2 of 3

Leslie Crisp  
Laboratory Director

Chad Lytle  
Senior Analyst

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**Samples Received:**  
8/7/08 10am

**Fax:** 519-652-1709

**Attn:**

**Purchase Order #:**

Sample#	Sample Concentration: parts per million (ppm)	Weight Percent:
20 Light Yellow paint – Location 92 – Custodial Storage	961.35	0.0961
21 Beige on Wall – Main floor – Location 76 – Custodial Storage	1278.03	0.1278
Lab Blank	< 1.00	----

## Quality Control:

**Duplicate:** 3.2 RPD

**Spike:** 98.3 % Recovery

NVLAP # 200349-0

Approved Signatories:

\_\_\_\_\_  
Henry Heiser  
Analyst

TDH # 30-0235

Page 3 of 3

\_\_\_\_\_  
Leslie Crisp  
Laboratory Director

\_\_\_\_\_  
Chad Lytle  
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Notes:  
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## **APPENDIX II**

### **ROOM BY ROOM SUMMARY**

**Client:** SNC-LAVALIN O&M  
**Project:** Designated Substances Survey  
**Building:** 185 Ouellette Avenue – Windsor, Ontario (Building ##5520060)



Location / Room Description		Lead in Paint Description	Reference Sample No. (Lead Weight %)	Mercury Thermostats	PCB Suspected in Light Ballasts
1	Storage (Sub Basement)	Grey Floor Paint Silver Wall Paint Yellow Wall Paint	VL-02 (0.3006%) 0.097% (L-01) 0.36% (L-02)	No	No
2	Fright Elev. Pit	No Access	No Samples Collected	No	No
3	Elev. Pit	No Access	No Samples Collected	No	No
4	Boiler Room (Lower Basement)	Grey Floor Paint Silver Wall Paint Yellow Wall Paint	VL-02 (0.3006%) 0.097% (L-01) 0.36% (L-02)	No	No
5	Ash Room	Grey Floor Paint Silver Wall Paint Yellow Wall Paint	VL-02 (0.3006%) 0.097% (L-01) 0.36% (L-02)	No	No
6	PCB Room	Grey Floor Paint Silver Wall Paint Yellow Wall Paint	VL-02 (0.3006%) 0.097% (L-01) 0.36% (L-02)	No	No
7	CCRA storage 002	Grey Floor Paint	VL-02 (0.3006%)	No	No
		White Paint on Walls/Ceiling	VL-03 (<0.0134%)	No	No
8	Storage	White Paint	Actual L-01 (<0.0252%)	No	No
		Grey Floor Paint	Actual L-02 (0.3006%)	No	No
9	Boiler Room Lower Basement	Grey Floor Paint	VL-02 (0.3006%)	No	No
10	Ash Room	Grey Floor Paint	VL-02 (0.3006%)	No	No
11	Storage	Grey Floor Paint	VL-02 (0.3006%)	No	No
12	Custodian Office	White Paint	VL-01 (<0.0252%)	No	No
13	Corridor	Epoxy Floor - New	Not Sampled	No	No
		White Paint on Walls/Ceiling	Actual L-03 (<0.0134%)	No	No
14	Catwalk	Grey Floor Paint	VL-02 (0.3006%)	No	No
15	Storage	Epoxy Beige Paint (New)	Not Sampled	No	No
16	Corridor	White Paint on Walls/Ceiling	VL-03 (<0.0134%)	No	No
17	Stairs	White Paint on Walls/Ceiling	VL-03 (<0.0134%)	No	No
18	Janitor Room	White Paint on Walls/Ceiling	VL-03 (<0.0134%)	No	No
19	Mens Washroom	White Paint on Walls/Ceiling	VL-03 (<0.0134%)	No	No
20	Storage	NA	Not Sampled	No	No
21	Pipe Chase	NA	Not Sampled	No	No
22	Storage	NA	Not Sampled	No	No
23	Telephone Room	Grey Floor Paint	VL-02 (0.3006%)	No	No

**Client:** SNC-LAVALIN O&M  
**Project:** Designated Substances Survey  
**Building:** 185 Ouellette Avenue – Windsor, Ontario (Building ##5520060)



Location / Room Description		Lead in Paint Description	Reference Sample No. (Lead Weight %)	Mercury Thermostats	PCB Suspected in Light Ballasts
24	CCRA Storage 002	Grey Floor Paint	VL-02 (0.3006%)	No	No
		White Paint on Walls/Ceiling	VL-03 (<0.0134%)	No	No
25	CCRA Storage 001	No Access	Not Sampled	No	No
26	Canada Post Corporation 006	Red Paint on Floor	Actual L-05 (0.7076%)	No	No
		Green Wall Paint	Not Sampled	No	No
27	Corridor	Green Paint on Wall	Actual L-06 (0.9829%)	No	No
		Grey Floor Paint	VL-02 (0.3006%)	No	No
28	Pump Room	White Paint on Walls/Ceiling	VL-03 (<0.0134%)	No	No
		Taupe Wall Paint –New	Not Sampled	No	No
29	CCRA Storage 003	Grey Floor Paint - New	Not Sampled	No	No
30	Electrical Room	N/A	Not Sampled	No	No
31	Storage	Grey Floor Paint	VL-02 (0.3006%)	No	No
		Green Paint on Wall	VL-06 (0.9829%)	No	No
32	CCRA Storage 004	Red Paint on Floor	VL-05 (0.7076%)	No	No
		Green Paint on Wall	VL-06 (0.9829%)	No	No
33	Men's Washroom	Grey Floor Paint	VL-02 (0.3006%)	No	No
34	Women's Washroom	No Access	Not Sampled	No	No
35	CCRA Corporate and Common Services 005	NA	Not Sampled	No	No
36	Janitorial Storage	White Ceiling Paint	Not Sampled	No	No
37	Storage	Grey Floor Paint	VL-02 (0.3006%)	No	No
		White Paint on Walls/Ceiling	VL-03 (<0.0134%)	No	No
38	Stairs	NA	Not Sampled	No	No
39	Elevator Lobby	Green Paint on Duct, Pipes & Structure	VL-08 (0.1717%)	No	No
40	Parking / Loading Garage	Grey Floor Paint	VL-02 (0.3006%)	No	No
		Green Paint on Duct, Pipes & Structure	Actual L-08 (0.1717%)	No	No
41	Elevator Lobby	Green Ceiling Paint	Not Sampled V-06 (0.1717%)	No	No
		Green Wall Paint	VL-02 (0.3006%)	No	No
42	Corridor	Grey Floor Paint	VL-06 (0.9829%)	No	No
		Green Paint on Wall	Not Sampled	No	No
43	Stairs	Green Paint on Wall	VL-06 (0.9829%)	No	No

**Client:** SNC-LAVALIN O&M  
**Project:** Designated Substances Survey  
**Building:** 185 Ouellette Avenue – Windsor, Ontario (Building ##5520060)



Location / Room Description		Lead in Paint Description	Reference Sample No. (Lead Weight %)	Mercury Thermostats	PCB Suspected in Light Ballasts
		Grey Floor Paint	Not Sampled	No	No
		White Ceiling Paint	Not Sampled	No	No
44	Chillier Room	Grey Paint on Wall Floor Paint	Old Green VL-06 (0.9829%) Not Sampled	No	No
45	Hoist Room	Grey Floor Paint	VL-02 (0.3006%)	No	No
		Green Paint on Wall	VL-06 (0.9829%)	No	No
46	CCRE 001	Renovated in 1990's	N/A	No	No
47	Office	Renovated in 1990's	N/A	No	No
48	Office	Renovated in 1990's	N/A	No	No
49	Men's Washroom	Renovated in 1990's	N/A	No	No
50	Women's Washroom	Renovated in 1990's	N/A	No	No
51	Ramp	Renovated in 1990's	N/A	No	No
52	Public Lobby		NA	No	No
53	Storage	White Paint on Walls/Ceiling	VL-03 (<0.0134%)	No	No
54	Corridor	White Paint on Walls/Ceiling	VL-03 (<0.0134%)	No	No
55	Corridor	White Paint on Walls/Ceiling	VL-03 (<0.0134%)	No	No
56	CCRA Receiving	White Paint on Walls/Ceiling	VL-03 (<0.0134%)	No	No
57	Vacant 004	NA	NA	No	No
58	Office	NA	NA	No	No
59	Corridor	White Paint on Walls/Ceiling	VL-03 (<0.0134%)	No	No
60	Storage	Drywall compound new	N/A	No	No
61	CCRA Mail Room 002	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
62	Lobby	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
63	Men's Washroom	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
64	Women's Washroom	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
65	Closet	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
66	Board Room	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
67	Vestibule	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
68	CPC 002	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
69	CPC Lunch Room	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
70	Storage Room	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
71	Storage Room	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No

**Client:** SNC-LAVALIN O&M  
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Location / Room Description		Lead in Paint Description	Reference Sample No. (Lead Weight %)	Mercury Thermostats	PCB Suspected in Light Ballasts
72	Elev. Lobby / Stairs	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
73	Storage	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
74	Women's Washroom	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
75	Men's Washroom	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
76	Janitor Closet	Beige Paint on Wall – Main Floor (green under)	Actual L-21 (0.1278%) 0.26% (L-06)	No	No
77	Canada Port Corporation	Beige Paint on Wall – Main Floor White Paint on Walls and Columns	VL-21 (0.1278%) Not Sampled	No	No
78	Loading Dock	Beige Paint on Wall – Main Floor White Paint on Brick	VL-21 (0.1278%) <0.0049% (L-12)	No	No
79	Elevator Lobby	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
80	Elevator Lobby	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
81	Storage	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
82	CPC Office	Beige Paint on Wall – Main Floor	VL-21 (0.1278%)	No	No
83	Office	New Renovation – Taupe Paint	Not Sampled	No	No
		Light Yellow Paint	VL-20 (0.0961%)	No	No
84	Office	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
85	CCRA 001	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
86	Board Room	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
87	Handicap Washroom	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
88	Public Lobby	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
89	Corridor	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
90	Women's Washroom	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation	Not Sampled	No	No
91	Men's Washroom	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation	Not Sampled	No	No
92	Jan.	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation	Not Sampled	No	No



Client: **SNC-LAVALIN O&M**  
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Location / Room Description		Lead in Paint Description	Reference Sample No. (Lead Weight %)	Mercury Thermostats	PCB Suspected in Light Ballasts
93	Mechanical Room	Light Yellow Paint	Actual L-20 (0.0961%)	No	No
		New Renovation	Not Sampled	No	No
94	Corridor	Light Yellow Paint	VL-20 (0.0961%)	No	No
		Beige over Green Wall Paint	3.4% (L-10)	No	No
95	Interview Room	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
96	Interview Room	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
97	Interview Room	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
98	Interview Room	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
99	Corridor	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
100	Interview Room	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
101	Reception	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
102	Office	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
103	CCRA	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
104	Office	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
105	Board Room	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
106	Lunch Room	New Renovation – Taupe Paint	Not Sampled	No	No
107	Corridor	New Renovation – Taupe Paint	Not Sampled	No	No
108	Corridor	New Renovation – Taupe Paint	Not Sampled	No	No
109	Vestibule / Stairs	New Renovation – Taupe Paint	Not Sampled	No	No
110	Men's Washroom	New Renovation	Not Sampled	No	No
111	Women's Washroom	New Renovation	Not Sampled	No	No
112	First Aid Room	New Renovation – Taupe Paint	Not Sampled	No	No
113	Office	New Renovation – Taupe Paint	Not Sampled	No	No
114	Office	New Renovation – Taupe Paint	Not Sampled	No	No

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Location / Room Description		Lead in Paint Description	Reference Sample No. (Lead Weight %)	Mercury Thermostats	PCB Suspected in Light Ballasts
115	Storage	New Renovation – Taupe Paint	Not Sampled	No	No
116	CCRA 001	New Renovation – Taupe Paint	Not Sampled	No	No
117	Office	New Renovation – Taupe Paint	Not Sampled	No	No
118	Corridor	Light Yellow Paint	VL-20 (0.0961%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
119	Storage	New Renovation – Taupe Paint	Not Sampled	No	No
120	Telecommunication Room	New Renovation – Taupe Paint	Not Sampled	No	No
121	Mechanical Room	New Renovation White Ceiling Paint	Not Sampled <0.0069% (L-11)	No	No
122	Office	New Renovation – Taupe Paint	Not Sampled	No	No
123	Administration	New Renovation – Taupe Paint	Not Sampled	No	No
124	Office	New Renovation – Taupe Paint	Not Sampled	No	No
125	Office	New Renovation – Taupe Paint	Not Sampled	No	No
126	CCRA 001	New Renovation – Taupe Paint	Not Sampled	No	No
127	Bond Room	New Renovation – Taupe Paint	Not Sampled	No	No
128	Women's Washroom	New Renovation	Not Sampled	No	No
129	Men's Washroom	New Renovation	Not Sampled	No	No
130	HC Washroom	New Renovation	Not Sampled	No	No
131	Vestibule	New Renovation – Taupe Paint	Not Sampled	No	No
132	Corridor	New Renovation – Taupe Paint	Not Sampled	No	No
133	Interview Room	New Renovation – Taupe Paint	Not Sampled	No	No
134	Mechanical Room	White Paint	VL-01 (<0.0252%)	No	No
		Beige Ceiling Paint	Actual L-14 (0.7256%)	No	No
135	Lobby	New Renovation – Taupe Paint	Not Sampled	No	No
136	Boardroom	New Renovation – Taupe Paint	Not Sampled	No	No
137	Storage	New Renovation – Taupe Paint	Not Sampled	No	No
138	Interview Room	New Renovation – Taupe Paint	Not Sampled	No	No
139	Interview Room	New Renovation – Taupe Paint	Not Sampled	No	No
140	Corridor	New Renovation – Taupe Paint Beige Ceiling Paint on Plaster	Not Sampled 0.22% (L-09)	No	No
141	Board Room	New Renovation – Taupe Paint	Not Sampled	No	No
142	Union	New Renovation – Taupe Paint	Not Sampled	No	No
144	Multi-Purpose Room	New Renovation – Taupe Paint	Not Sampled	No	No
145	Board Room	New Renovation – Taupe Paint	Not Sampled	No	No

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Location / Room Description		Lead in Paint Description	Reference Sample No. (Lead Weight %)	Mercury Thermostats	PCB Suspected in Light Ballasts
146	Office	New Renovation – Taupe Paint	Not Sampled	No	No
147	Administration	New Renovation – Taupe Paint	Not Sampled	No	No
148	Program Sup.	New Renovation – Taupe Paint	Not Sampled	No	No
149	Storage	New Renovation – Taupe Paint Yellow Column Paint	Not Sampled 0.28% (L-07)	No	No
150	Storage	New Renovation – Taupe Paint	Not Sampled	No	No
151	Training Room	New Renovation – Taupe Paint	Not Sampled	No	No
152	Office	New Renovation – Taupe Paint	Not Sampled	No	No
153	Vestibule	New Renovation – Taupe Paint	Not Sampled	No	No
154	Vestibule / Stairs	New Renovation – Taupe Paint	Not Sampled	No	No
155	Men's Washroom	New Renovation	Not Sampled	No	No
156	Women's Washroom	New Renovation	Not Sampled	No	No
157	Office	New Renovation – Taupe Paint	Not Sampled	No	No
158	Janitor	New Renovation	Not Sampled	No	No
159	Office	New Renovation – Taupe Paint	Not Sampled	No	No
160	Office	New Renovation – Taupe Paint	Not Sampled	No	No
161	Office	New Renovation – Taupe Paint	Not Sampled	No	No
162	Office	New Renovation – Taupe Paint	Not Sampled	No	No
163	Office	New Renovation – Taupe Paint	Not Sampled	No	No
164	CCRA Open Office 001	New Renovation – Taupe Paint Yellow Column Paint	Not Sampled 0.15% (L-08)	No	No
165	Office	New Renovation – Taupe Paint	Not Sampled	No	No
166	Corridor	New Renovation – Taupe Paint	Not Sampled	No	No
167	Fan Room	White Paint	VL-01 (<0.0252%)	No	No
		Grey Floor Paint	VL-02 (0.3006%)	No	No
168	Mechanical Room	White Paint	VL-01 (<0.0252%)	No	No
		Grey Floor Paint	VL-02 (0.3006%)	No	No
169	Office	New Renovation – Taupe Paint	Not Sampled	No	No
170	Office	New Renovation – Taupe Paint	Not Sampled	No	No
171	Office	New Renovation – Taupe Paint	Not Sampled	No	No
172	Corridor	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
173	Elevator Lobby	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No

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Location / Room Description		Lead in Paint Description	Reference Sample No. (Lead Weight %)	Mercury Thermostats	PCB Suspected in Light Ballasts
174	Corridor	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
175	Corridor	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
176	CCRA 002	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
177	Storage	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
178	Stairs	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
179	Vestibule	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
180	Open Office	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
181	Interview Room	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
182	Interview Room	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
183	Office	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
184	Interview Room	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
185	Interview Room	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
186	HC Washroom	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
187	Storage	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
188	Women's Washroom	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation	Not Sampled	No	No
189	Men's Washroom	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation	Not Sampled	No	No
190	Mechanical Room	White Paint	VL-01 (<0.0252%)	No	No
		Beige Ceiling Paint	VL-14 (0.7256%)	No	No

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Location / Room Description		Lead in Paint Description	Reference Sample No. (Lead Weight %)	Mercury Thermostats	PCB Suspected in Light Ballasts
191	Library	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
192	Storage	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
193	Lan Room	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
194	Corridor	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
195	Open Office	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
196	Office	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
197	Board Room	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
198	Training Room a/b	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
199	Office	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
200	Interview Room	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
201	Storage	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
202	PR/Fax	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
203	Corridor	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
204	Office	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
205	Office	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
206	Office	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
207	Women's Washroom	Beige Paint on Walls	VL 18 (0.1604%)	No	No

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Location / Room Description		Lead in Paint Description	Reference Sample No. (Lead Weight %)	Mercury Thermostats	PCB Suspected in Light Ballasts
		New Renovation	Not Sampled	No	No
208	Men's Washroom	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation	Not Sampled	No	No
209	Jan.	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		Green Paint on Plaster	Actual L-16 (0.2505%)	No	No
210	Staff	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
211	Canada Customs and Revenue Agency 001	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
212	Office	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
213	Office	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
214	Office	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
215	Office	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
216	Supply Room	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
217	File Room	Beige Paint on Walls	Actual L 18 (0.1604%)	No	No
218	Printer Room	Beige Paint on Walls	VL 18 (0.1604%)	No	No
		New Renovation – Taupe Paint	Not Sampled	No	No
219	Telephone Room	Beige Paint on Walls	VL 18 (0.1604%)	No	No
220	PWGSC 005 Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
221	Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
222	CCRA 002 Open Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
223	CCRA 001 Lunch Room	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
224	HC Washroom	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
225	Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
226	001 Storage	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No



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Location / Room Description		Lead in Paint Description	Reference Sample No. (Lead Weight %)	Mercury Thermostats	PCB Suspected in Light Ballasts
227	Corridor	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
228	Mechanical Room	White Paint	VL-01 (<0.0252%)	No	No
		Beige Ceiling Paint	Actual L-14 (0.7256%)	No	No
229	CCRA 001 Open Office	Beige Ceiling Paint	VL-14 (0.7256%)	No	No
230	Elevator Lobby	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
231	Corridor	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
232	Women's Washroom	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
233	Men's Washroom	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
234	Corridor	Brown Base Coat/ White Overcoat Paint Ivory Paint	VL-15 (1.9472%) 0.12% (L-5)	No	No
235	001 Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
236	CCRA 002 Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
237	003 Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
238	CCRA	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
239	003 Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
240	CCRA 003 Boardroom	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
241	003 Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
		Beige Paint on Wall	Actual L-17 (0.1297%)	No	No
242	003 Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
243	Elevator Penthouse	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
244	Elevator Penthouse	Beige Paint on Structural Steel	Actual L-19 (0.6847%)	No	No
245	Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
246	Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
247	Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
248	Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
249	001 Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
250	002 Open Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
251	HC Washroom	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
252	Storage.	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
253	Corridor at Elevators	White Paint on Walls/Ceiling	VL-03 (<0.0134%)	No	No
		Brown Base Coat/ White Overcoat Paint	Actual L-15 (1.9472%)	No	No
254	001 Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
255	Boardroom	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No

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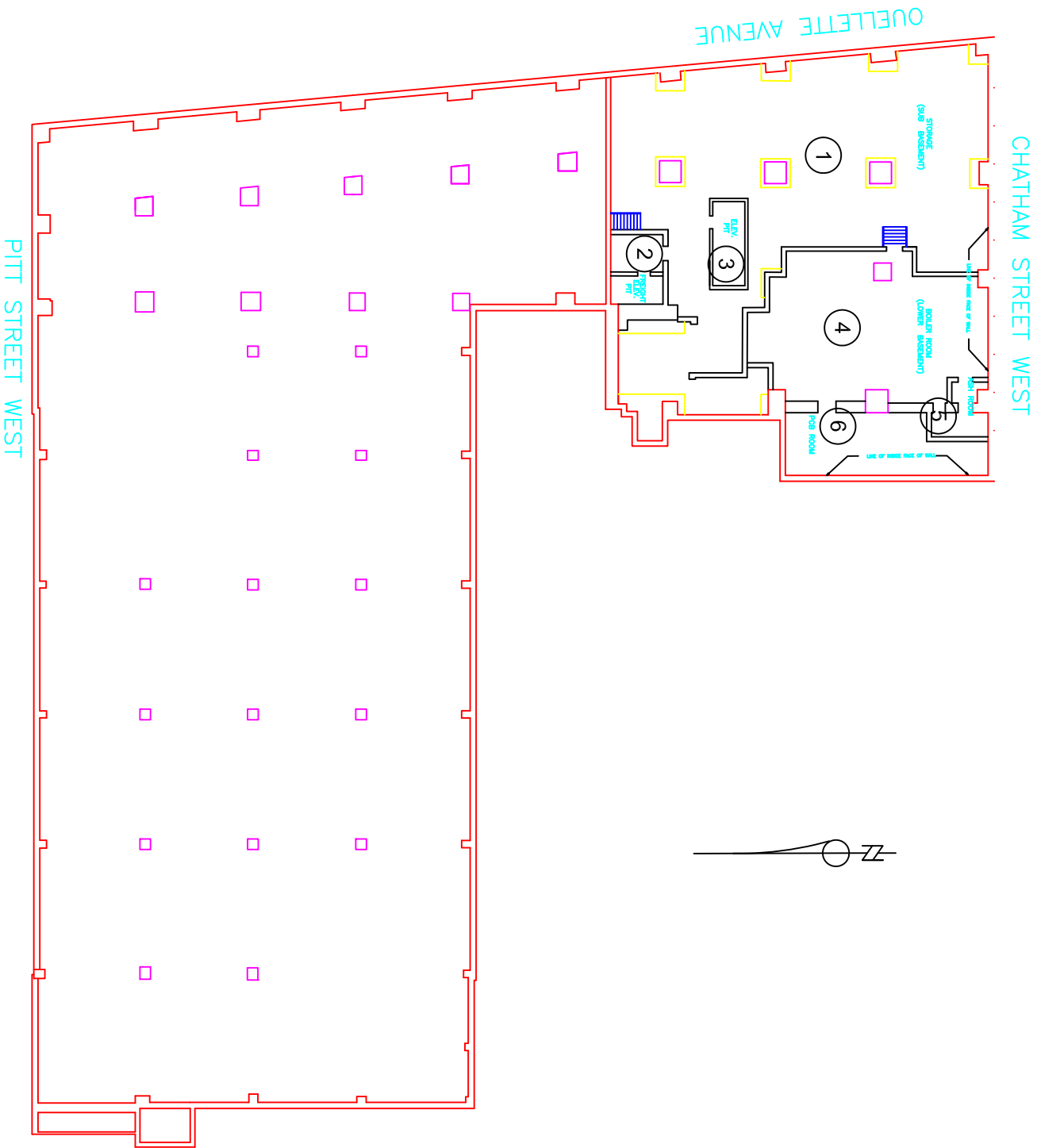



Location / Room Description		Lead in Paint Description	Reference Sample No. (Lead Weight %)	Mercury Thermostats	PCB Suspected in Light Ballasts
256	Mechanical Room	White Paint	VL-01 (<0.0252%)	No	No
		Beige Ceiling Paint	VL-14 (0.7256%)	No	No
257	Corridor	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
258	Women's Washroom	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
259	Men's Washroom	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
260	Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
261	Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
262	Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
263	CCRA 003 Open Office	Brown Base Coat/ White Overcoat Paint Beige/Yellow Column Paint	VL-15 (1.9472%) 1.2% (L-04)	No	No
264	004 Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
265	004 Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
266	Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
267	Lunch Room	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
268	Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
269	003 Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
270	003 Office	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
271	Files	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
272	Stairs	Brown Base Coat/ White Overcoat Paint	VL-15 (1.9472%)	No	No
273	Mechanical Penthouse	Green paint on Structural Beam	Actual L-11 (0.2054%)	No	No
		Beige paint on Window Liner	Actual L-12 (0.1962%)	No	No
		Black Window Trim Paint	Actual L-13 (4.3355%)	No	No
		Grey Floor Paint	0.041% (L-03)		




### **APPENDIX III**

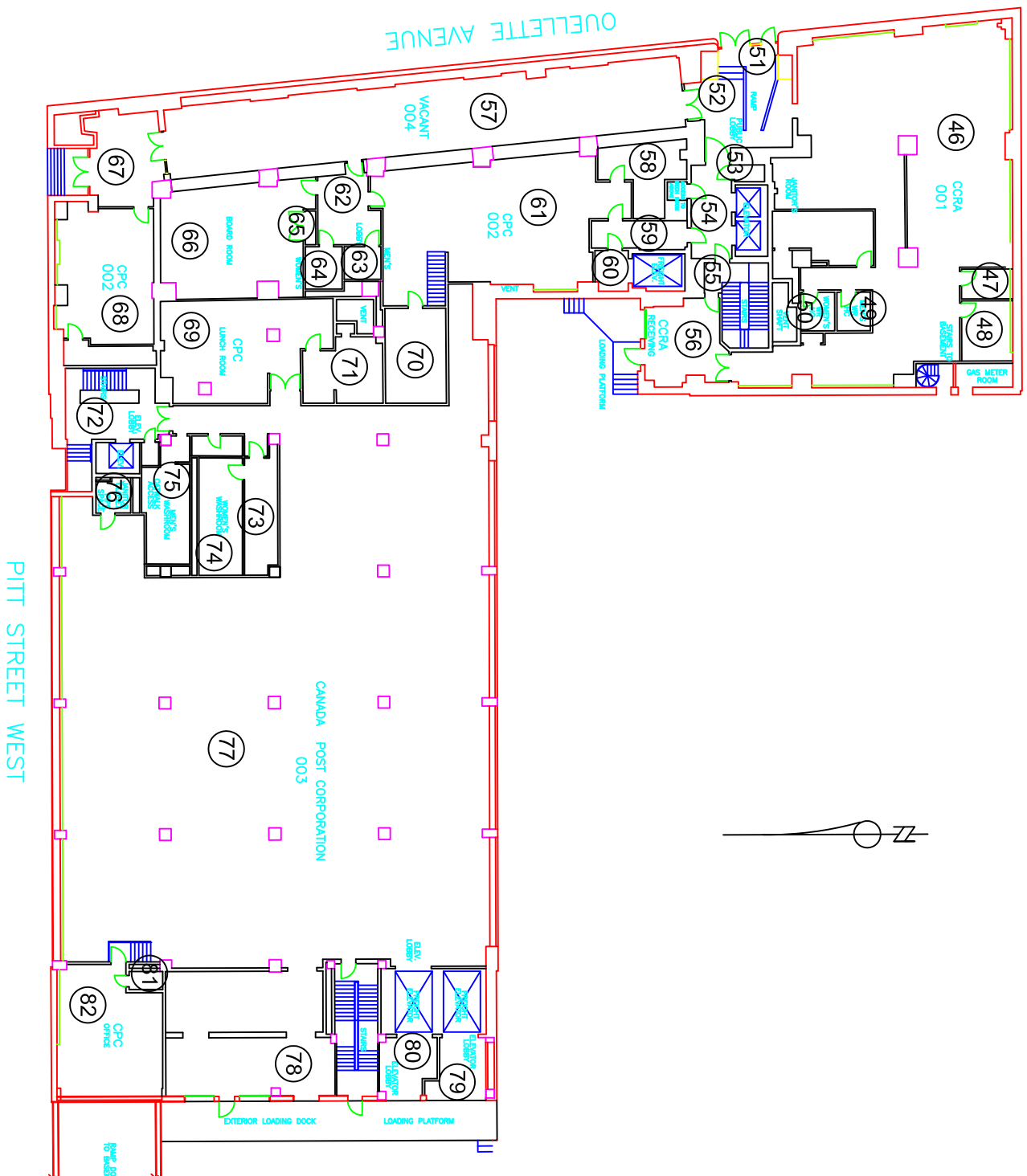
### **BUILDING DRAWINGS**




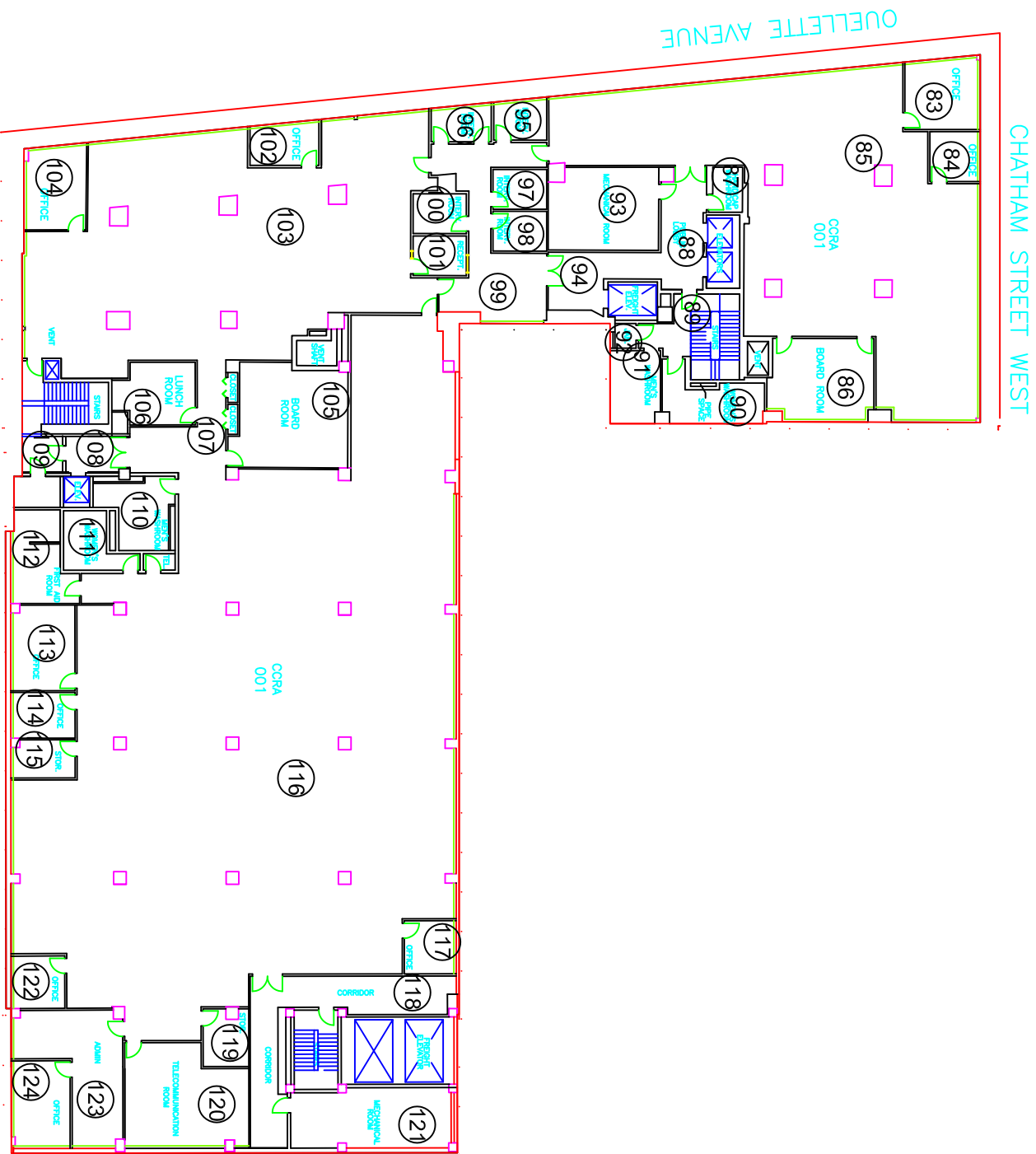
 OH SOLUTIONS		OH Solutions Inc. 233 Mitchell Avenue Dorchester, Ontario N0L1G3 Tel: (519) 268-2200 Fax: (866) 700-4975	
Designated Substances Assessment			
Government of Canada Building Sub-Basement 185 Ouellette Avenue Windsor, Ontario Building # 5520060			
SCALE NTS	DATE: 12/20/12	OH PROJECT: 12-030	
DRAWING #: 001			



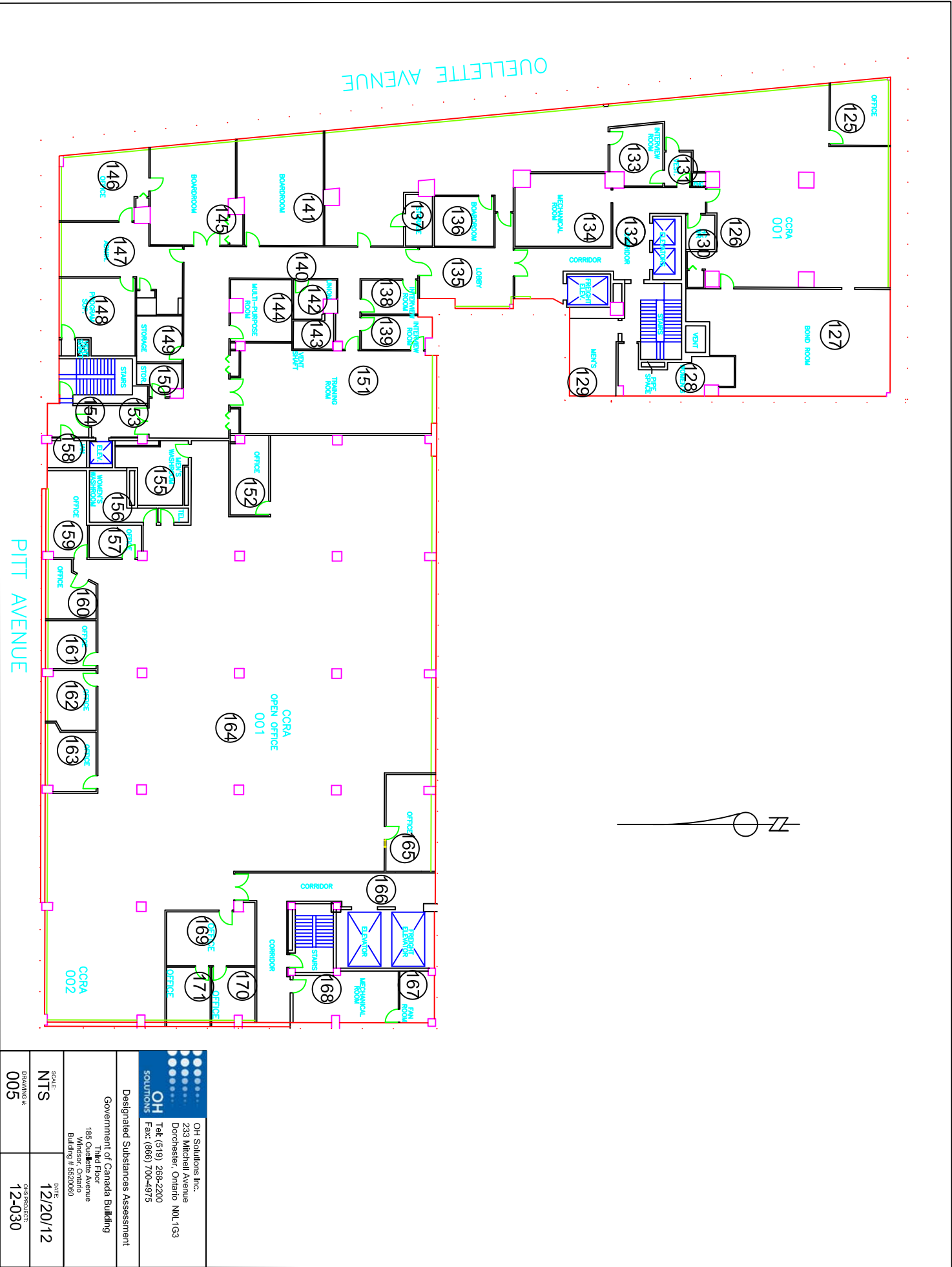
 <b>OH</b> solutions		OH Solutions Inc. 223 Mitchell Avenue Dorchester, Ontario N0L 1G3 Tel: (519) 289-2200 Fax: (866) 700-4975
Designated Substances Assessment		
Government of Canada Building Basement 186 Queen's Avenue Windsor, Ontario Building # 5520360		
SCALE: <b>NTS</b>	DATE: <b>12/20/12</b>	
DRAWING # <b>002</b>	OHS PROJECT: <b>12-030</b>	

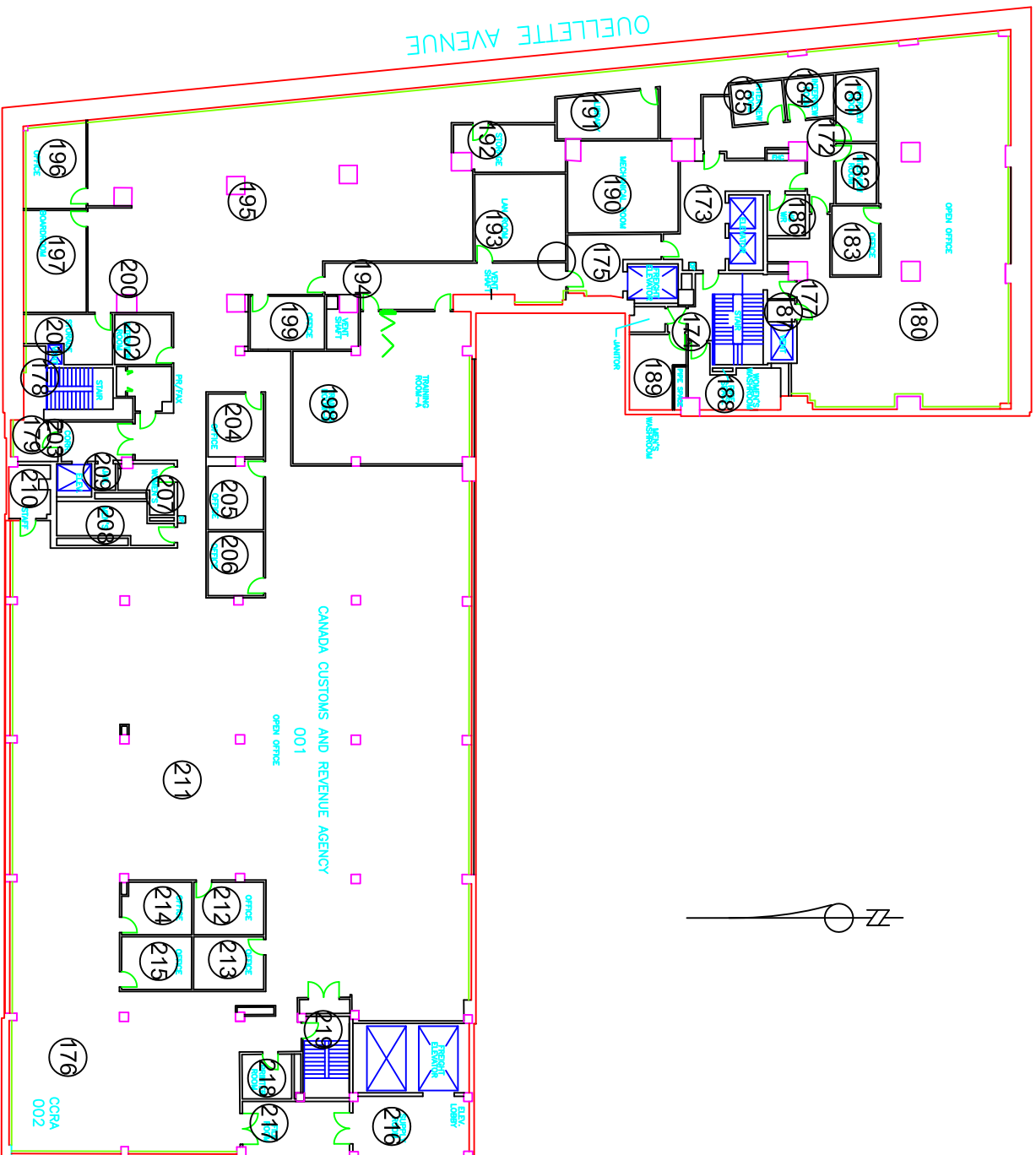



	OH Solutions Inc. 233 Mitchell Avenue Dorchester, Ontario N0L 1G3 Tel: (519) 268-2200 Fax: (866) 700-6975	
	Designated Substances Assessment	
Government of Canada Building Main Floor 185 Charlotte Avenue Windsor, Ontario Building # 5520060		
STYLE NTS	DATE 12/20/12	DRAWING # 003
ORG PROJECT: 12-030		




<b>OH SOLUTIONS</b> OH Solutions Inc. 233 Mitchell Avenue Dorchester, Ontario N0L1G3 Tel: (519) 268-2200 Fax: (866) 700-4975	
Designated Substances Assessment Government of Canada Building Second Floor 185 Ouellette Avenue Windsor, Ontario Building # 5520060	
SCALE: <b>NTS</b> DRAWING #: <b>004</b>	DATE: <b>12/20/12</b> DRAWN BY: <b>12-030</b>



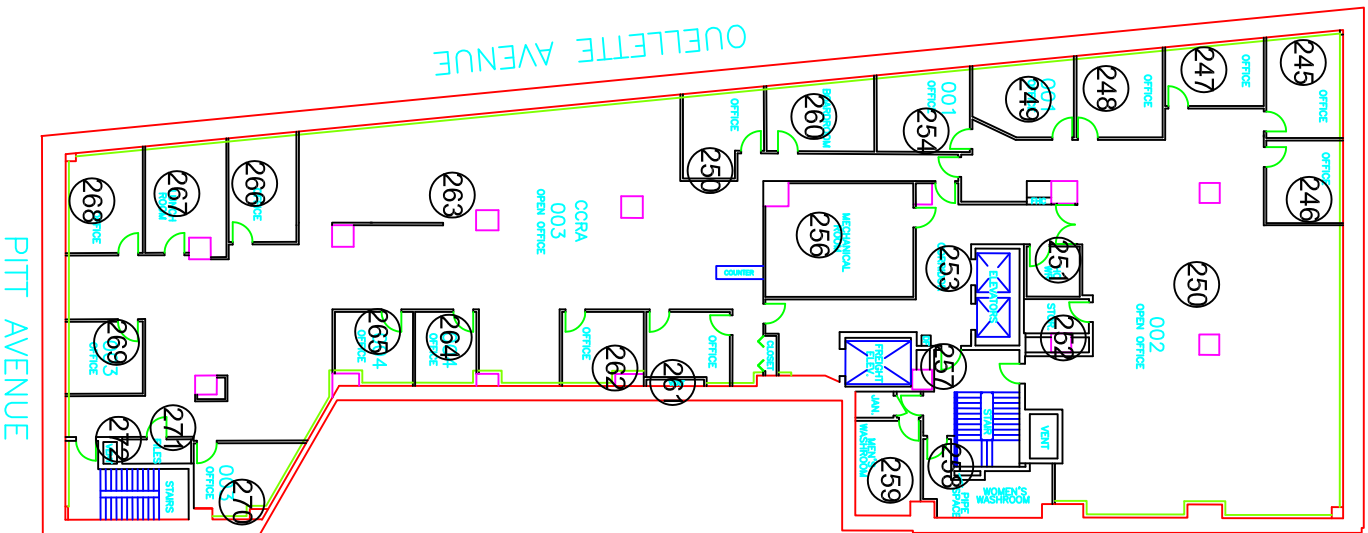



 OH Solutions Inc. 233 Mitchell Avenue Dorchester, Ontario N0L 1G3 Tel: (519) 268-2200 Fax: (866) 700-4975	
Designated Substances Assessment	
Government of Canada Building	
Fourth Floor 185 Ouellette Avenue Windsor, Ontario Building # 5520060	
SCALE: NTS	DATE: 12/20/12
DRAWING #: 006	ON PROJECT: 12-030



	
<p><b>OH Solutions Inc.</b>          233 Mitchell Avenue          Dorchester, Ontario N0L1G3          Tel: (519) 288-2200          Fax: (866) 700-4975</p>	
<p><b>Designated Substances Assessment</b></p>	
<p><b>Governor of Canada Building</b>          Fifth Floor          185 Ouellette Avenue          Windsor, Ontario          Building # 5520080</p>	
<p>DATE:  <b>NTS</b></p>	<p>DATE:  <b>12/20/12</b></p>
<p>DRAWING #:  <b>007</b></p>	<p>QHS PROJECT:  <b>12-030</b></p>

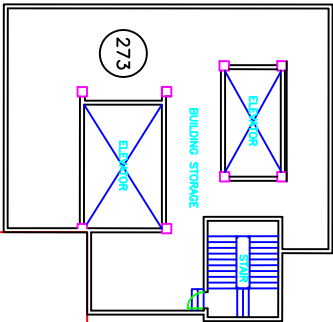





 OH SOLUTIONS		OH Solutions Inc. 233 Mitchell Avenue Dorchester, Ontario N0L 1G3 Tel: (519) 288-2200 Fax: (866) 700-4975	
Designated Substances Assessment		Government of Canada Building Sixth Floor 185 Ouellette Avenue Dorchester, Ontario Building # 5520060	
SCALE: NTS	DATE: 12/20/12	DATE: 12/20/12	
DRAWING #: 008	DATE: 12-030		


QUELLETTE AVENUE

ROOF ABOVE THE SIXTH FLOOR



 OH solutions		OH Solutions Inc. 233 Mitchell Avenue Dorchester, Ontario N0L1G3 Tel: (519) 268-2200 Fax: (866) 700-4975			
Designated Substances Assessment					
Government of Canada Building Lower Penthouse 185 Ouellette Avenue Windsor, Ontario Building # 5520060					
SCALE: NTS	DATE: 12/20/12	OH PROJECT: 12-030			
DRAWING #: 009					



	OH Solutions Inc. 233 Mitchell Avenue Dorchester, Ontario N0L1G3 Tel: (519) 288-2200 Fax: (866) 700-4975
	OH SOLUTIONS
Designated Substances Assessment	
Government of Canada Building Upper Peninsula 186 Duquette Avenue Windsor, Ontario Building #5520060	
DATE: 12/20/12	DATE: 12/20/12
DRAWING # 0710	OH PROJECT: 12-030



March 12<sup>th</sup>, 2017

Project # 17-1048

Public Works Government Service of Canada  
115 Toronto Road  
Port Hope, Ontario L1A 3S4

Attention: Ms. Jessica Zhou

**RE: LEAD PAINT SAMPLING – 185 OUELLETTE AVENUE - WINDSOR, ONTARIO**

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## **INTRODUCTION**

OH Solutions Inc. (OHS) was retained by Public Works Government Service of Canada to collect and submit samples of suspected lead-containing paint for laboratory analysis within the upcoming office fit-up area at the above noted address.

The sample was submitted on March 8<sup>th</sup>, 2017. The following report outlines the analytical sampling results.

## **METHODOLOGY AND RESULTS**

OHS collected all samples of distinct painted finishes for determination of lead content. Where possible, OHS removed all layers of paint down to the buildings components unpainted surface. Samples of suspected lead-containing paint samples were collected and subsequently submitted for analysis. The suspected lead-containing paints were analyzed using flame atomic absorption spectroscopy (F.A.A.S.).

OHS submitted samples of the suspected lead paint to Crisp Analytical Laboratories, in Carrollton, Texas, USA.

The results of the analysis are presented below:

- The cream wall paint was collected from the new Evidence Room. Lead was detected at a concentration of 0.1997%

## CONCLUSIONS AND RECOMMENDATIONS

The Environmental Abatement Council of Ontario has published a guideline (Lead Guideline for Construction, Renovation, Maintenance or Repair, 2014) that establishes a de minimis (i.e. virtually safe) level of lead in paint or surface coatings where a hazard would not likely be present. This guideline recommends procedures to protect against lead exposure when concentrations of lead in paint exceed 0.1% by weight, but suggests that finishes with concentrations below 0.1% by weight do not require lead specific precautions provided the material is not disturbed in an aggressive manner (e.g. grinding or sandblasting) and that general dust control is adequate.

Elevated airborne lead levels can result when uncontrolled work procedures such as drilling, cutting, removing, grinding, etc. are used on lead-based materials. The control of dust levels during the demolition of the buildings can be accomplished through proper work practices to reduce overall dust levels and providing workers with proper personal protective equipment.

The paint samples submitted for analysis was above 0.1% lead. Based on the 2014 EACO guideline, these paints should be considered lead-containing paints and therefore should follow the appropriate classifications of Work Operations and corresponding procedures set forth in the Guideline.

## CLOSURE

OHS has prepared this report for the exclusive use of our Client. OHS will not be responsible for the use of this report by any third party, or reliance on or any decision to be made based on it without the prior written consent of OHS. OHS accepts no responsibility for damages, if any, by any third party because of decisions or actions based on this report. In addition, the liability due to any responsibility arising out of or relating to this report for OHS, and its officers, directors, employees and agents will be limited to the stated value of the work. However, OHS will not be liable for any consequential, incidental or indirect damages as a result of the performance of this work.

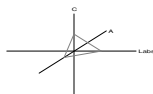
We trust that this information is sufficient for your present purposes. Should you have any questions regarding this matter, please do not hesitate to contact our office.

Respectfully submitted,

Jeff Doherty, B.Sc.  
Senior Occupational Hygienist



Enclosure: Certificate of Analytical Results



## Atomic Absorption Lead Report

Analysis Method: Lead in Paint analyzed by Atomic Absorption (AA)/SW-846-7420;  
This analysis is not covered by the scope of accreditation by NVLAP or AIHA.

Sample Prep Method: Samples are dissolved in nitric acid, extracted, and analyzed on a properly calibrated AA; Absorbency curve was calculated, bandwidth corrected, and wavelength at the time of the analysis was measured and recorded.

**Client Information:**  
OH Solutions  
119 Thames St S  
Ingersoll, ON N5C 2T3

**Phone:** 519-485-2500  
**Fax:** 866-700-4975

**Client Project:**  
17-1050, 185 Ouellette

**Turnaround Time:** 24 Hours  
**Attn:**

**CA Labs Project #:**  
CAL17031297JE

**Date of Sampling:** None Given  
**Report Date:** 3/9/17  
**Samples Received:** 3/9/17 10:30am  
**Purchase Order #:**

Sample#	Sample Concentration: parts per million (ppm)	Weight Percent:
P1 Cream – Wall Paint	1,996.90	0.1997
Lab Blank	< 1.00	----

**Quality Control:**

All samples received in good condition unless noted

**Duplicate:** 1.0 RPD  
**Spike:** 99.1 % Recovery

NVLAP # 200349-0

Approved Signatories:

Julio Robles  
Analyst

TDH # 30-0235

Page 1 of 1

Leslie Crisp  
Laboratory Director

Chad Lytle  
Senior Analyst

Notes:  
The current guidelines for lead in paint from the Consumer Products Safety Council (CPSC) is 0.06% by weight; the Housing and Urban Development (HUD) guideline is 0.5% by weight.

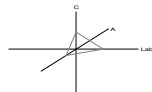
CA Labs is participating in ELPAT rounds sponsored by American Industrial Hygiene Association (AIHA) and National Lead Laboratory Program (NLLAP). This test reports relates only to the items tested. Neither AIHA, NVLAP nor EPA accreditation implies endorsement by any US Government agency. CA Labs is accredited by the American Industrial Hygiene Association (AIHA LAP, LLC.) in the TEM, PLM, and PCM asbestos fields of testing for Industrial Hygiene and in the culturable fungi field of testing for Environmental Microbiology. This report may not be reproduced except in full without written permission from CA Labs. This Method is not covered by the AIHA accreditation for Environmental Hygiene.

These results are submitted pursuant to CA Labs' current terms and condition of sale, including the company's standard warranty and limitation of liability provisions and no responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified in writing to return the samples covered by this report, CA Labs will store the samples for a period of ninety (90) days before discarding. A shipping and handling fee may be assessed for the return of any samples.

Analysis performed at Crisp Analytical Labs, LLC 1929 Old Denton Road Carrollton, TX 75006; phone (972) 242-2754, fax (972) 242-2798.

**CA Labs**

Dedicated to Quality

**Crisp Analytical, L.L.C.**1929 Old Denton Road  
Carrollton, TX 75006  
Phone 972-242-2754  
Fax 972-242-2798**CA Labs, L.L.C.**12232 Industriplex, Suite 32  
Baton Rouge, LA 70809  
Phone 225-751-5632  
Fax 225-751-5634

**ATOMIC ABSORPTION  
LEAD ANALYSIS  
LABORATORY ANALYSIS REPORT**

**OH Solutions**119 Thames St S  
Ingersoll, ON N5C 2T3

Reference number: CAL17031297JE

**LABORATORY ANALYSIS:**

Summary of lead analysis by atomic absorption in all relevant media using the method described in SW-846-7420. All analysts have received the necessary in-house and extramural training to perform analysis of samples for the presence of lead. A duplicate analysis is performed on greater than ten percent of all samples. A spiked concentration sample is analyzed with each sample group for instrument calibration. All analysts are required to participate in quality control analysis rounds. Instrument calibrations are performed on a daily, weekly, and monthly basis.

**CA Labs is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) for selected test methods for airborne fiber analysis (TEM) and by the USEPA for analysis of asbestos in drinking water. CA Labs is accredited by the American Industrial Hygiene Association (AIHA LAP, LLC) PLM, TEM and PCM Asbestos fields of testing for industrial hygiene.** This analysis is not covered by the scope of accreditation by NVLAP. This method is not covered by the AIHA accreditation for Industrial Hygiene.

This report must not be used to claim product endorsement by AIHA or any agency of the U.S. Government. This test relates only to the items described and tested herein. This report may not be reproduced except in full, without written permission by CA Labs.

**METHOD:**

The procedure for paint chip analysis follows AOAC5.009(974.02) and SW-846-7420. The analysis of soil, wipes, and wastewater for the presence of lead is also referenced by SW-846-7420. Methodology for the analysis of lead in air samples follows NIOSH Method 7082.

Analysis performed at Crisp Analytical Labs, L.L.C. 1929 Old Denton Road Carrollton, TX 75006: phone (972) 242-2754; fax (972) 242-2798.